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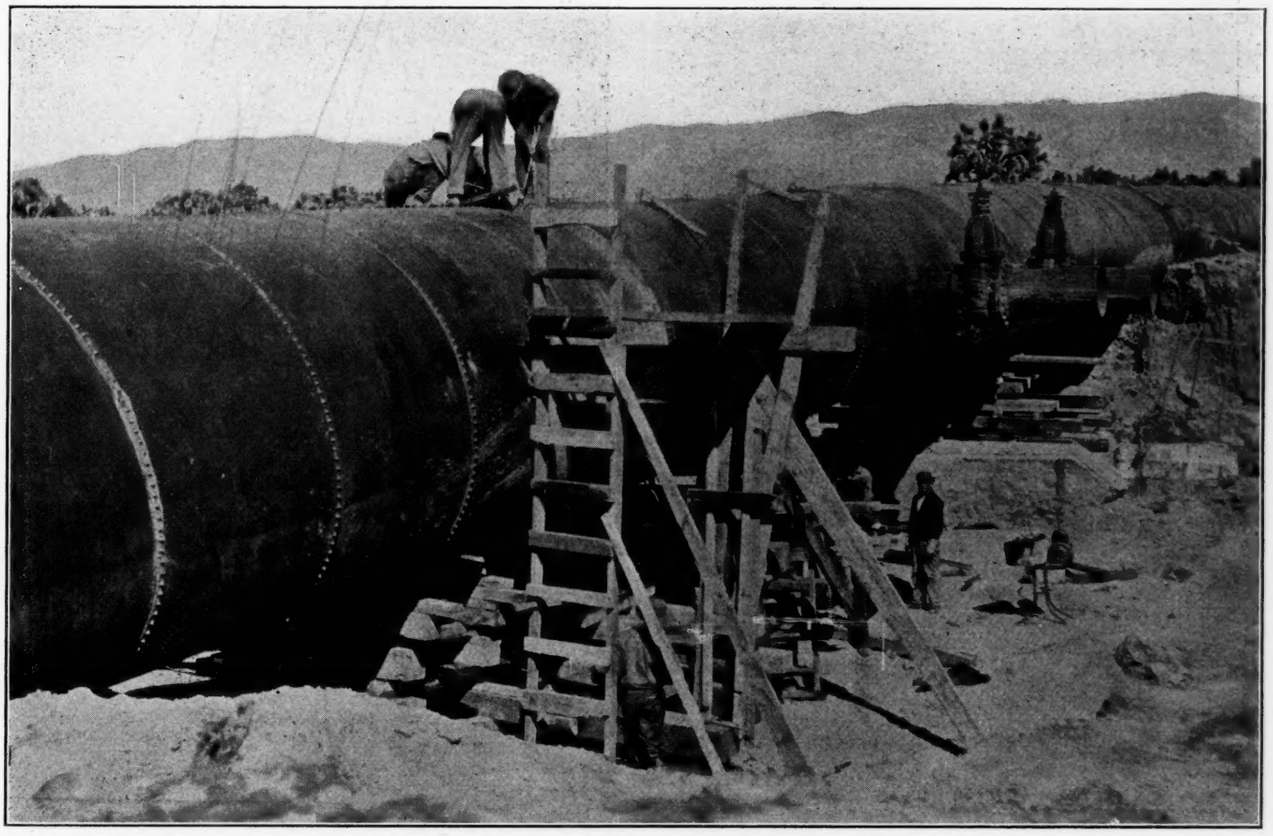


WASHOUT WHERE RUPTURE OF PIPE OCCURRED.
Photograph Taken March 14, Showing New Section in Place.

RESTORING THE LOS ANGELES SIPHON

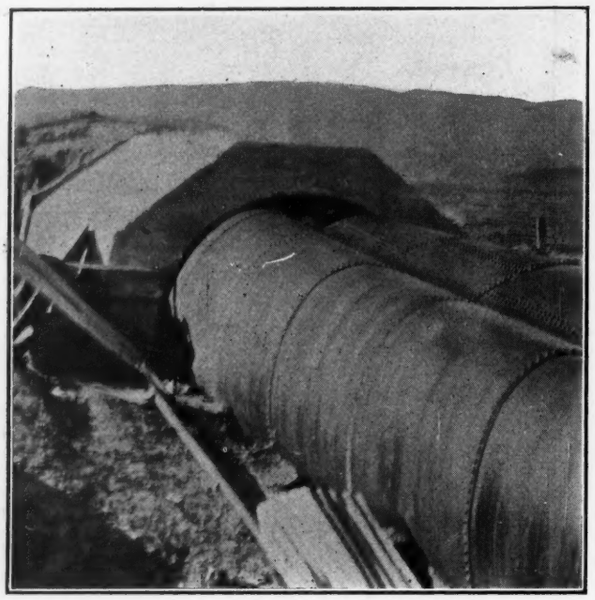
Collapse of a Ten-Foot Steel Pipe Line of the Los Angeles Aqueduct and Its Complete Restoration by Use of Hydraulic Pressure—Repairing a Result of the February Floods.

By BURT A. HEINLY.

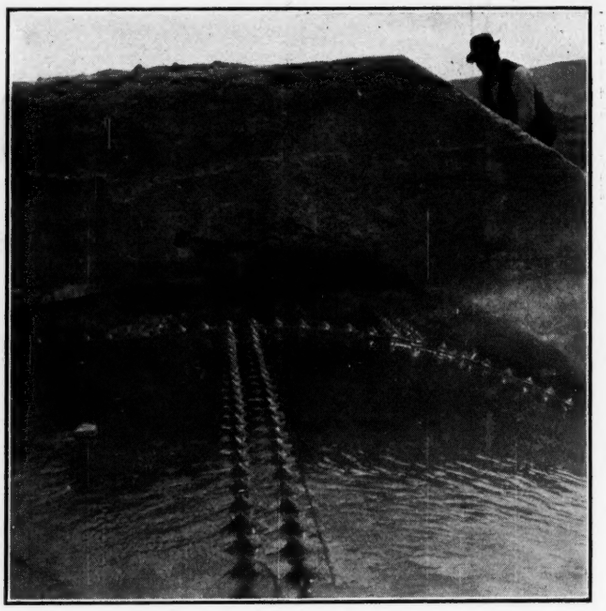
In the three days' storm which brought havoc to the southern part of California during the later part of February, the Los Angeles aqueduct, the 233-mile watercourse recently completed by that municipality for carrying a water supply from the Sierra Nevadas to the city, did not escape damage. A break in this line was caused by a washout at a point 85 miles northwest of Los Angeles, where the aqueduct crosses the head of the Antelope valley by means of an inverted siphon comprising 6,150 feet of reinforced concrete pipe and 15,597 feet of steel pipe, all ten feet in diameter.

The rupture and collapse of the steel pipe and its repair within 29 days after the accident form at once a most unusual example of the terrific force of atmospheric pressure acting over a large area and the equally remarkable results obtainable from hydraulic pressure; for the pipe was restored, at insignificant expense, to perfect roundness by this means. The 15,597 feet of pipe, it is stated, is the longest single pipe line of such large diameter in existence.

The steel portion of the siphon comprises 7,249 feet of ¼-inch, 3,698 feet of 5/16-inch and 4,650 feet of ⅜-inch plate. At each end the head is 70 feet, with a maximum head of 200 feet at a point near its center. The two ends of the siphon are of 10-ft. reinforced concrete pipe, 2,736 feet at one end and 3,414 at the other. As there are no summits and the siphon is open at the ends, air valves would have served no adequate purpose, and none were installed. The steel portion was constructed in the fall of 1912 at a cost of $249,200.



COLLAPSE AT SOUTHERN JUNCTION WITH CONCRETE PIPE.



RETURN TO NORMAL SHAPE AT JUNCTION WITH CONCRETE PIPE.

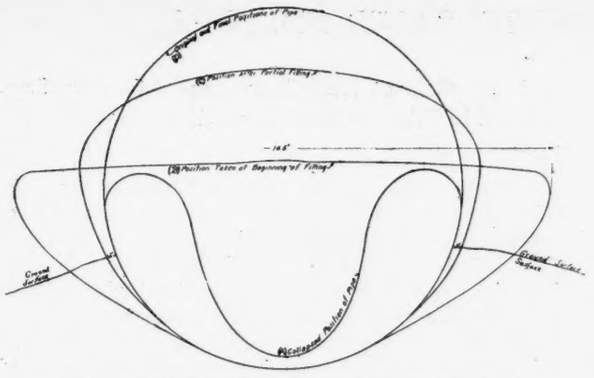
The siphon lies about half buried in the ground, and at the middle of the valley crosses, on two concrete piers, the small and shallow ravine which carries the drainage of the valley. The region is semi-arid in character with a mean annual precipitation of about 8 inches. However, on February 18, 19 and 20 there was a rainfall of 11.6 inches in the seventy-two hours. The small ravine at the siphon crossing was greatly widened and deepened, causing the piers to topple over and precipitate the siphon into the wash, with a rupture of the pipe at one of the seams. The aqueduct was carrying water at the time, and under the head of 200 feet, or 86 pounds to the square inch, the water rushed out with great velocity. The water escaped at the break more rapidly than it flowed at the two ends of the siphon, with the result that a vacuum was created about half way up each leg of the siphon, which caused the pipe to collapse at these points.

The north leg begins below the concrete pipe with 891 feet of ¼-inch plate double-riveted, followed by 1,805 feet of ¼-inch plate triple riveted and 1,415 feet of 5/16-inch triple riveted. At the bottom of the valley is 4,650 feet of ⅜-inch triple riveted; and the south leg contains in succession 2,283 feet of 5/16-inch triple riveted, 2,754 feet of ¼-inch triple riveted and 1,799 feet of ¼-inch double riveted. The collapsed pipe included all of the ¼-inch plate, both double and triple riveted, and all of the 5/16-inch pipe on the upper leg and about half of that on the lower leg. The top of the pipe was forced in by the atmospheric pressure so that in places it was only a few inches from the bottom of the pipe. At a point 400 feet from the north end of the pipe the rivets on two plates were sheared and the plate torn, the cause of this being speculative.

Predictions were made by several engineers who visited the scene that the siphon was a total loss and must be either entirely rebuilt with new steel or else the rivets must be cut, each sheet taken out and re-

COLLAPSED PIPE BEFORE WATER WAS TURNED ON.

RETURN UNDER WATER PRESSURE BEGINNING.



CROSS SECTIONS OF COLLAPSED SIPHON.
(A) Collapsed position; (B) position taken at beginning of filling; (C) after partial filling; (D) original and final positions.

rolled and the pipe then refabricated—a process which, even if practical, would have been little cheaper than using entirely new plates.

But William Mulholland, the chief engineer, thought differently. New plates were ordered from Los Angeles to replace those torn, and on March 10 were delivered at the nearest railroad station and hauled by wagon 35 miles overland to the scene of the accident. These were riveted together on new piers erected in the wash and connected up with the uninjured pipe on either side of the break. Mr. Mulholland's plan consisted in undertaking to make water undo what air had done. On March 19th, a flow of 750 miners inches was turned into the siphon, this being later increased to 2,000 inches. Slowly and evenly under a head not at first exceeding more than two or three feet, the siphon resumed its normal form. In so doing, it assumed the successive shapes shown in the accompanying diagram. Not more than two dozen rivets were sheared in the whole operation and all of these were confined to the circular seams. So successful was the work that for stretches of hundreds of feet there was no leaking whatsoever. At other points the use of the caulking tool was here and there required on some of the round seams. At the transitions, however, where the pipe enters the concrete approaches and where, in the building, the concrete was poured around the pipe, the restoration by hydraulic pressure was so perfect that the conical heads of the rivets found their identical position in the concrete, and there was no leakage whatsoever.

At three points near the upper end of the collapse, where new plates were inserted to closing gaps before the water was turned on, larger plates had to be inserted in the top of the siphon than were taken out. With the application of hydraulic pressure, the extra length of the top had to find position, and no give at either end of the pipe being possible, owing to anchorage in the concrete, the pipe buckled near the new plates in order to take up the extra length. Only at these places and at points longitudinal where the bend in the pipe was severe and the paint has cracked, could the casual observer discover the hard test to which this pipe line has been submitted. The whole cost of repairing the damage due to collapse has not amounted to probably more than $250, while the whole work of replacing and increasing the number of concrete piers, with replacement of fractured plates, will not add more than $1,800 to $2,000 to this amount.

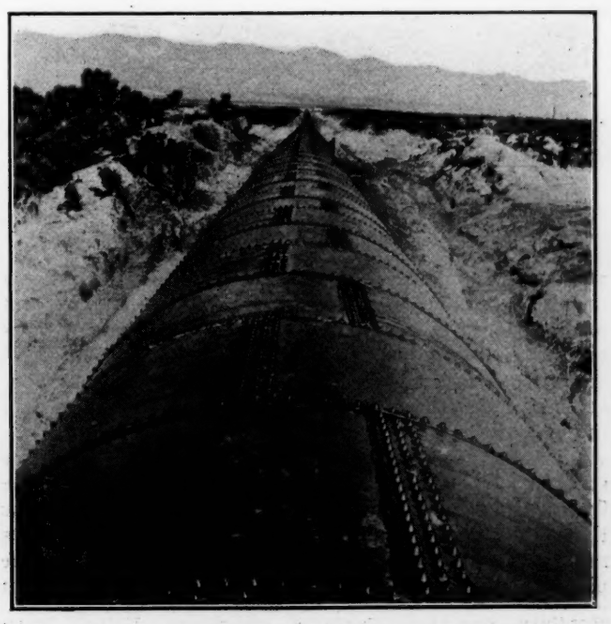
While of comparatively small consequence from a financial standpoint in a work costing $24,500,000, the break and repair of this piece of steel work is a most interesting and instructive incident.

INDUSTRIAL AND DOMESTIC CONSUMPTION.

Louisville during 1913 consumed an average of 108 gallons per capita or 119 gallons per consumer. But the industrial consumption—that used by manufacturing industries, railroads, saloons and other business purposes—amounted to 39.4 per cent of the total, and if that be deducted the domestic consumption is found to be but 66 gallons per day per inhabitant, this including street sprinkling, fire prevention and leakage and waste.

If comparison between consumption rates in different cities are to be made, it would seem that the information obtained would be valueless unless allowance be made in each case for the very considerable effect upon the rates of the non-domestic uses, which would vary in almost every case. A still further subdivision into domestic proper (that used in residences) and public (street sprinkling, sewer flushing, etc., and leakage) should be easy where all services are metered, and would permit even more informative data.

PIPE IN POSITION B OF THE SKETCH.



PIPE COMPLETELY RESTORED TO SHAPE.

OPERATION OF SMALL RAPID SAND FILTERS

Appliances for Regulating the Amounts of Chemicals Applied in the Case of Both Pumped and Gravity Supplies—Use of Coagulation Basins—Maintaining Sand in Filters—Rate Controllers

By H. P. LETTON*

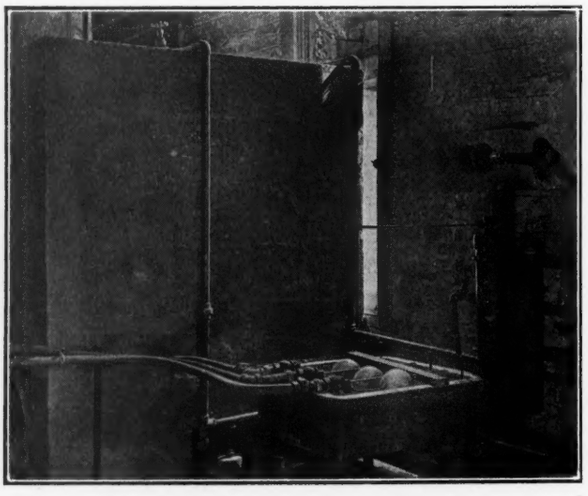
REGULATION OF CHEMICAL DOSAGE.

The regulation of the chemical dosage is one of the most difficult and yet one of the most important steps in the whole filtration process. The dose should be applied to the water proportionally at all times. In those plants that pump the raw water, this is comparatively easy, as the rate of pumpage usually remains fairly constant at any one time. For these plants an arrangement for applying the chemical in constant amounts is very satisfactory. There are on the market several good constant head calibrated orifice boxes for this purpose. If a plant is not equipped with a calibrated orifice box, the following scheme will be found to work very well. A float is put in each solution box and connected by a wire running over one or more pulleys to a pointer sliding on a scale of feet and inches. By measuring the depth of the tank and knowing the number of pounds of chemical put in to make a tankful of solution, the number of pounds of chemical per inch of depth can be readily computed. The orifice can now be set so that the solution in the tank will fall the required number of inches per hour. The writer has seen many plants where the flow of chemical was regulated simply by means of a globe valve on a line leading direct from the solution tank. This is very bad practice, because the flow cannot be accurately measured by means of a globe valve and because, as the head of solution in the tank lowers, the rate of discharge varies. A constant head orifice box should always be used. A box of this kind can be made by using the float-controlled valve from an ordinary flush tank. If this is not convenient, a piece of soft rubber tubing can be slipped over the end of the inlet pipe, which should be pointed downwards. In the other end of the tube there should be stuck a narrow flask, and just below the mouth of the flask a small hole should be cut in the rubber tube. As the solution rises in the box, the flask will float, thus raising the tube until it is kinked where attached to the pipe, and the flow entirely cut off. If a flask is not handy, a large incandescent lamp will answer the purpose just as well. The box itself may be made either of concrete or of wood lined with copper or lead, or simply a half barrel or keg. If this last is used in connection with hypochlorite, it should be lined with cement, as described in the first article of this series.

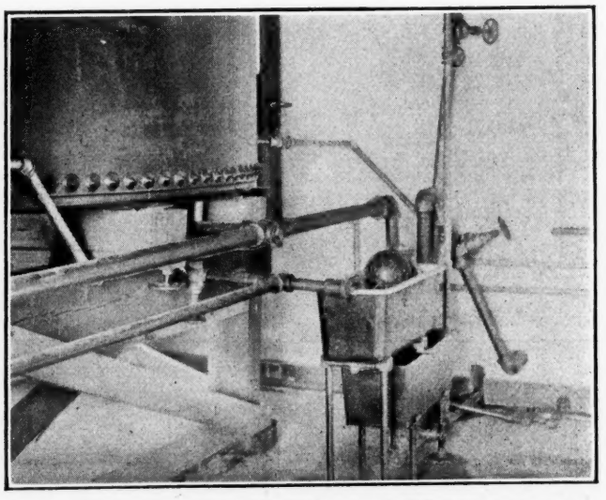
The best valve to use as an orifice for regulating the flow, is a taper valve, to the top of which is soldered a long arm so that small adjustments can be easily made. Another arrangement which will probably be found more satisfactory than a valve, is to have a half-inch brass pipe extend through a stuffing box arrangement in the bottom of the orifice tank, and on the end of the pipe there should be screwed a cap, having either a one-sixteenth or a one-eighth inch hole drilled therein. By this arrangement the tube can be moved up or down, thus varying the head over the orifice in the cap, and by having several caps with different sized holes, almost any flow can be obtained. The stuffing box arrangement is easily made by passing the tube through a large rubber stopper, and through a hole in an iron plate. This plate can be fastened to the bottom of the box by means of screws, and tightening these will compress the cork and make a water tight joint.

There are on the market several forms of automatic dosing devices which are of course preferable to the above, but where a plant is not so equpped, the arrangement described will give excellent results. Several of the automatic devices are operated by means of the change in velocity caused by constricting a pipe line by the Venturi principle. These will not give satisfactory results in the very small plant as they require a considerable flow of water to work well. Several forms of apparatus are manufactured which are worked by some reciprocating part of the engine and thus give a proportional dose.

When a plant is supplied by gravity, it is much more difficult to regulate the dose, as there is usually no way to measure the amount of water. It will, however, generally be found possible to fit up a weir box at the entrance to the coagulation basin and by this means



AUTOMATIC DOSING DEVICE
Operated by Venturi tube and feeding soda ash, sulphate of alumina, and calcium hypochlorite in proportional parts.



STEEL SOLUTION TANK AND ORIFICE BOX.
Showing plugged tees and crosses.

*Sanitary Engineer, Hygienic Laboratory, United States Public Health Service.

measure the flow at intervals and regulate the chemicals accordingly.

COAGULATION BASINS.

In order to cause efficient coagulation, it is absolutely necessary that the solution of sulphate of alumina be thoroughly mixed with the water. Where the solution is added before pumping, good mixing is usually effected by the passage through the pumps and pipe lines. Where it is added as the water enters the coagulation basin, there should be placed small baffles or other similar arrangements to cause a thorough mixture.

The period necessary for coagulation and sedimentation is from 2 to 4 hours with most water, and the coagulation basin should therefore have sufficient capacity to hold two to four hours' supply of water. It is often found that the basins are too small, as a result of which the filters are overloaded and in some cases there is even a formation of aluminum hydrate in the filtered water. It may be found that the theoretical storage is sufficient, but that the actual storage is small. This is a common occurrence in the cylindrical wooden tanks which formerly were much used. Where tanks of this kind are used, they should have horizontal baffles placed in them so that the whole volume of the tank will be effective.

Too long a storage period is undesirable because the flock all settles and there is none left in the water entering the filters to form a suitable slime layer on the surface of the sand. This condition is found at times in many small plants which only operate part of the day. It is a common occurrence to find plants that during most of the year operate less than twelve hours a day. Under such a condition, the water in the coagulation basin, at the beginning of the day, has had over twelve hours storage and the water entering the filters will contain no aluminum hydrate to form a suitable slime layer on the sand. In such cases it is advisable that the filters be washed during the morning, after having been in operation two to four hours, as that will leave a considerable layer sediment on the sand at the beginning of the next day, at which time the water is deficient in aluminum hydrate

The water should be taken from the coagulation basin as near the surface as possible. This will reduce to a minimum the amount of suspended matter carried to the filters.

Pressure filter plants are generally not equipped with coagulation basins and as a result their efficiency is lowered, more wash water is required, and, at times, aluminum hydrate is found in the filtered water due to the fact that the reaction is not completed before the water passes through the filters. Often-times pressure filters are added to an existing waterworks which has a stand pipe for maintaining pressure, and the stand pipe used as a coagulation basin, the water being pumped in at the bottom and taken out to the filters at a point perhaps half way up. Such an arrangement usually results in a short actual period of coagulation and practically no sedimentation. It is urged that, under circumstances of this kind, the advisability of constructing a suitable coagulation basin, in which the water can be treated before being pumped to the filters, be investigated. The writer is of the opinion that in many cases such a change would be found to save money on account of the necessity for less chemical, and because less wash water would be used.

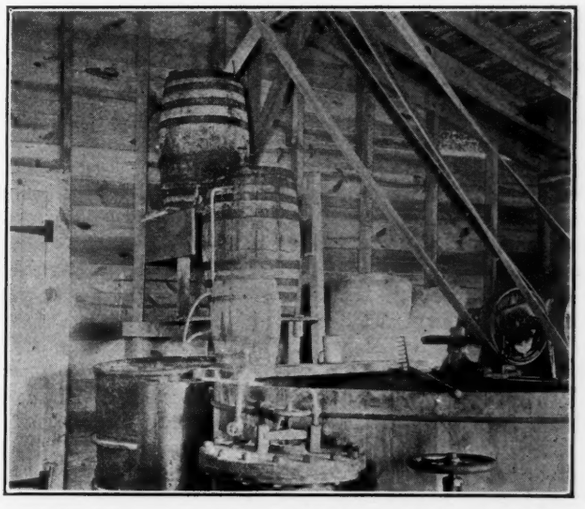
The economic importance of removing all possible sediment and color in the coagulation basins is not generally appreciated at the small plant. When it is realized, however, that as more sediment is taken out by the sand bed, more wash water is required, and that every extra gallon of wash water used is a direct economic loss, the value of efficient coagulation and sedimentation will be understood.

There should be as little agitation as possible in the line leading from the coagulation basin to the filters, in order that the flock carried by the water be not broken up.

FILTERS.

Formerly gravity rapid sand filters were built circular, in the form of wooden tanks, but in the past few years they have almost all been constructed of concrete and rectangular in shape. There is absolutely no difference in the principle of the two types, the only difference being in the method of washing the sand. Pressure filters are built of steel in the form of cylindrical tanks either upright or horizantal. They operate in the same way as gravity filters except that the water is pumped through them, the influent and effluent both being under pressure. It is also commonly found that no coagulation basin is used in connection with pressure filters, which makes their efficient operation very difficult.

In most filters, when first constructed, there is put about thirty inches depth of sand. This sand is generally of the correct size, but as time goes on, and some of it is carried away with the wash water, it is often replaced with sand either too fine, which causes clogging and consequent frequent washing, or too coarse, which makes the filter inefficient in removing bacteria or turbidity. The sand does not ordinarily depreciate appreciably and does not need to be replaced unless its size changes. The writer knows of several plants where the sand was changed at regular intervals, when as a matter of fact, this was not required at all. The sand should have what is known as an effective size of from 0.35 millimeters to 0.45 millimeters, and a uniformity coefficient of not more than 1.6. The effective size is that size than which ten per cent by weight is smaller and ninety per cent by weight larger. The uniformity coefficient is the ratio of the size than which ten per cent by weight is smaller to the size than which sixty per cent of the weight is smaller. If there is any doubt as to the quality of the sand, a sample should be sent to a state or other laboratory for examination, and a new sand should not be bought unless on the above specifications and unless it has been examined to determine if these specifications have been followed. It is a common belief that the sharpness of the sand grains is a factor in the quality, but as a matter of fact this has noth-



EMERGENCY CALCIUM HYPOCHLORITE PLANT.
Erected by the writer in three hours, and in use over two years.

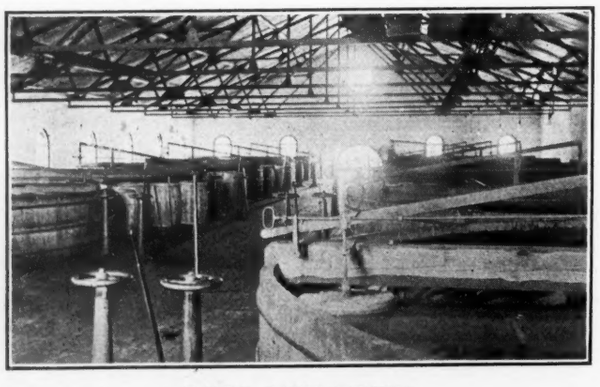
ing to do with the effectiveness of the sand for filtration. The only factor of importance is the size of the particles and their uniformity. From thirty to thirty-six inches of sand should be kept in the filter and as it is carried away with the wash water new sand should be added.

In most filters there is from eight to twelve inches of graded gravel over the strainer system and below the sand. Unless the strainers become clogged, this gravel should never be disturbed, but if it is removed for any purpose, it should be regraded before replacing. If this grading is not done, there is danger of the sand working down into the gravel and clogging the strainer system.

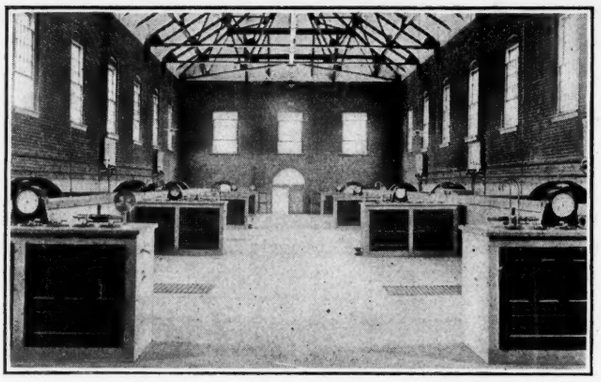
In some filters the arrangement for applying the coagulated water to the sand beds is so constructed that the incoming water keeps part of the surface of the bed constantly in agitation, thus preventing the formation of a layer of sediment which will entangle and hold back the bacteria. Where the above is the case, a change should be made to prevent such agitation. The trouble is often caused by the filter operating at a too rapid rate and taking away the water as fast as it is applied, thus leaving a head of only an inch or so over the surface of the sand. The incoming water spilling over the sides of the gutters then stirs up the sand. Sometimes the trouble is not that the filtered water is being removed too fast, but that the coagulated water is not being applied fast enough. Small filters are equipped with butterfly valves attached to a float which closes the influent valve when the head on the filter becomes too great. A plant is someimes found where these valves are out of order, and instead of fixing them, the attendant regulates the flow by hand and, in order to prevent overflowing, he sometimes goes to the other extreme with the result described above. There should always be kept a head of eighteen inches or more of water above the sand surface. Where the trouble is caused by the incoming water all entering at a high velocity at one point, the only remedy is to change the arrangement by which the water is supplied to the filters. One very satisfactory way in which this may be done is to extend the influent pipe across the bed and allow the water to flow onto the sand through small holes in the top of the pipe.

The rate of filtration is another point to which little attention is usually given. The normal rate for rapid sand filters is 125,000,000 gallons per acre of surface per twenty-four hours. This is approximately two gallons per square foot per minute. Another way of expressing it is that it corresponds to a fall of 3.19 inches per minute.

The rate can be measured at any time by simply shutting off the inflow of water to the filter, and measuring the fall of the water in the filter for one minute. This testing can easily be done by making a gauge out of a piece of strap iron in which are riveted or screwed two right angled hooks with the points just 3.19 inches apart. This is hung in the filter and the time for the water to fall between the points is taken. If it takes less than a minute, the normal rate is being exceeded.



RAPID SAND FILTER.
Showing hand-operated valves; also float valve for controlling head of water in filter.



MODERN RAPID SAND FILTER.
Showing operating tables for controlling hydraulic valves.

The normal rate can be exceeded somewhat for a time without causing any marked loss in efficiency, but it is not advisable to so increase it unless absolutely necessary. The filter should never be operated above the normal rate immediately after washing, as at such times the efficiency is low and bacteria are liable to be carried through the sand bed.

Every filter should, if possible, be equipped with some form of rate controller which will absolutely prevent too rapid filtration. There are several types of controllers, any of which will give satisfactory results, and it is highly desirable that plants not so equipped make every effort to obtain them. When a plant is not equipped with rate controllers, careful attention should be paid to the filter effluent valve, only partially opening it when starting a filter after washing, and the rate should be tested at intervals. In this manner fairly successful results can be obtained. Wherever rate controllers are part of the equipment, they should occasionally be tested as above.

Pressure filters can not be fitted with rate controllers quite so easily as gravity filters, and yet the need for them is generally greatest in this type of plant. Unless they are used, there is considerable danger of greatly exceeding the normal rate at times, and when this rate is exceeded for any length of time, the surface layer will be broken and bacteria carried through the bed. In fact, any sudden changes in the rate of filtration, such as are often apt to occur with pressure filters, are liable to cause a lowered efficiency.

HOUSING WATER METERS.

Experience with water meters in reducing waste has, been very gratifying in Huntington, N. Y. The superintendent of the water works company, Thomas E. Irwin, says that between 1909, when only about 100 meters were in use, and 1913, when 98 per cent of the services were metered, the per capita consumption decreased very considerably.

"When we adopted the meter system," writes Mr. Irwin, "I did not give thought enough to the housing of water meters and the result was that during the severe winter of 1912 we had a very large number of our meters frozen; the method of installation being mostly in the cellars, and so many houses being of the cheaper class which have no heat in the cellar, the result was a frozen meter.

"We are now endeavoring to make the installation of all our meters in boxes, but of course this is a large expense at the outset, and it is well to educate our people up to see the necessity of it; but it will eventually come, I think.

"Again, there is tampering with the water meter, not perhaps for the purpose of changing or interfering with the correct registration, but plumbers give us considerable trouble who, in making repairs in a house, remove the meter and leave it on the cellar floor, but make no report of the same to us. There it will remain possibly for two or three months, or until our regular reading time, when our reader discovers our meter is off and we have no registration for that time. By housing the meters in boxes this can be entirely overcome, by having a proper lock and furnishing no key to this lock except to an employee of the company.

WATERWORKS OF COLUMBUS, OHIO

Cost of Pumping, Filtering and Softening—Sulphate of Alumina for Softening—Description of New Lime Bins and Weighing Apparatus.

One of the most interesting statements made by Jerry O'Shaughnessy, superintendent of the Division of Water of Columbus, Ohio, in his report for the year 1913, is the following: "Now that it has been shown that the department may be made an absolutely self-sustaining institution, I heartily agree with the mayor in his proposal to have the Division of Water pay full interest on bonds and all sinking fund charges, and to issue bonds for future extensions of the plant.

"Briefly, I would further recommend that some measure be adopted whereby the water works may be paid for water now gratuitiously distributed; or, at least, the general installation of meters on such service so that wastage may be restricted."

In this report Mr. O'Shaughnessy has given very complete information concerning the operation of the plant, excellently classified and indexed, including full statistics in accordance with the form of the New England Water Works Association. From these we learn that the cost of pumping per million gallons, figured on pumping station expenses, was $8.61; that the cost of purification, figured on purification works expenses was $16.08. The total amount pumped was about 6,500 million gallons, which was lifted first by low lift pumps to the purification plant and then by direct service pumps, the quantities being based upon the pump counters, with no allowance for slip. About 60 per cent of this amount was metered; about 25½ per cent was unaccounted for, and the remainder was flat rate and free water. The receipts from water rents averaged $73.30 per million gallons pumped. The cost of supplying water per million gallons, figured on total operating expenses, was $47.31, or $55.50 if interest and sinking fund payments be included.

Among the items given showing the cost of supplying about 6,500 million gallons of water were the following: Purifying and softening: wages of employees, $23,760; repairs to buildings, $260; repairs to machinery, $32; repairs to other equipment, $1,016; office and laboratory supplies, $1,571; heavy chemicals, $69,999; general supplies, $2,708; oil, waste and machinery supplies, $170; miscellaneous expenses, $1,411; a total of $100,928. (The item of wages should probably have been distributed over some of the other items, for these include only costs other than labor.) Meter repairs cost as follows: Wages of employees, $14,971; meter repair parts, $4,102; miscellaneous expenses, $855; a total of $19,928. The total number of meters in service at the end of the year was 28,851, of which 2,158 were set during the year.

As a part of his report the superintendent includes the report of the purification works made by Chas. P. Hoover, the chemist in charge. Mr. Hoover's report gives a very complete description of the new lime storage bins and weighing apparatus, together with the other appliances used in the plant, which is very interesting and which we quote below. This plant as originally built was quite fully described in our issues of May 4 and 11, 1910. During 1913 it softened and purified an average of 18.3 million gallons per day, which is about 800,000 gallons more than during 1912. The total amounts of chemicals used were as follows: 3,629 tons of lime costing $5.17 per ton; 2,895 tons of soda ash costing $12.88 per ton; 711 tons of alum costing $17.10 per ton, and 17 tons of hypochlorite costing $27.80 per ton. The average results during the year were as follows: Hardness reduced from 271 parts per million in the raw water to 88 in the filtered water. Total bacteria per c.c. reduced from 6,310 in the raw water to 15 in the filtered water. The suspended matter in the raw water average 69 parts per million, with a maximum of 2,000 and a minimum of 7; while that in the filtered water never exceeded 5 parts, and during a very large percentage of the time was zero.

The city derives its water from the Scioto river. A dam across the river 4½ miles above the pumping station creates a reservoir 5.8 miles long, having a capacity of 1,720 million gallons. The elevation of the crest of this dam is 73 feet above city datum, and would deliver water to the purification plant by gravity if a conduit had been laid from the reservoir to the plant. As it is, the water flows from the reservoir in the bed of the river, and is impounded by a small dam 200 feet below the pumping station, from which it is pumped by a low lift pump into the purification works. As it enters the purification works the water receives standard solutions of aluminum sulphate, soda ash and lime, after which it is passed through baffled mixing tanks. On leaving these it passes very slowly through a set of settling basins, this occupying about 18 hours, and the effluent from these basins is filtered through mechanical sand filters. The sludge collected in the settling basins is flushed into the river.

The lime is added to remove the temporary hardness, and the soda ash to remove the permanent hardness. The permanent hardness of the Scioto river is due to the presence of sulphates of calcium and magnesium, and during the year 1913 averaged 111 parts per million, which was reduced to 28 parts in the filtered water. The sulphate of alumina is in most plants used only as a coagulant, but at this plant it is also used to reduce the temporary hardness. From one-half to one grain of alum added to the settled water before it goes to the filters will reduce the alkalinity from 20 to 30 parts per million; whereas, theoretically, one grain of alum should only reduce the temporary hardness about 8 parts per million. A long series of experiments has been started to find out if possible why such large reductions in alkalinity are obtained by the application of alum to softened water. The data available at the time of this report seemed to indicate that the magnesium present in the river water combines with the alum and soda ash to from a colloidal precipitate of basic carbonate of magnesium, and that the flocculent precipitate formed by the addition of alum drags down this colloidal precipitate, thus reducing the hardness.

Another interesting study made at the plant was in connection with the effect of lime on typhoid and intestinal bacteria. It was found that such bacteria would live for only a short time in a lime-softened water, because the lime absorbs the carbonic acid from the water,

and these bacteria will not live in water free from carbon dioxide. This information has proved very helpful in operating the plant. For instance, if the water is being slightly undertreated with lime, and samples of the settled water show presumptive B. Coli tests, the lime feed is immediately increased, enough lime being added to completely neutralize the temporary hardness, and an additional amount added sufficient to give the water 4 or 5 parts per million caustic alkalinity, and immediately the positive presumptive tests for intestinal organisms become negative.

This information was also put to good service during the flood of March, 1913, when it was necessary to stop pumping for a period of twenty-four hours because a section of 36-inch pipe was washed out by the flood. The distribution system was drained and the health authorities advised consumers to boil the water. When pumping was resumed the water at the plant was treated with enough lime to neutralize the temporary hardness of the water, and, in addition, enough to introduce 15 to 20 parts per million of caustic alkalinity. Twenty-four hours after samples taken from all parts of the distribution system showed by chemical tests the presence of excess lime or caustic alkalinity the water was found to be bacterially pure. "This treatment is safe; it does not introduce any taste into the water, and there is no evidence except by chemical tests to indicate the presence of the causticity in the water."

NEW LIME BINS AND WEIGHING APPARATUS.
(From Report of Chas. P. Hoover, Chemist in Charge.

At the time the water purification plant was put in operation all of the chemicals to be used in softening and purifying the water were handled and stored in canvas bags. The original chemical storage house consists of one large room 59 ft. 8 in. wide by 105 ft. long, and has an estimated capacity of 900 tons. The first consignment of lime, consisting of several hundred tons, was delivered in bags, each containing a net weight of 100 lb. The bagged material was stored in the chemical storehouse, but before it could be used it had air slaked and almost all of the bags had burst, demonstrating conclusively the inadvisability of storing lime in bags. Further trouble was also experienced while using lime delivered in bags, in maintaining a uniform application of the chemical to the water, and it was found that the bags of lime varied in weight from 10 to 15 pounds per bag.

After this experience of storing sacked lime, it was decided to buy lime delivered in box cars loaded in bulk. A reserve stock of lime amounting to about 60 tons was stored in steel drums provided with an 8-inch screw top. Arrangements were also made with the lime contractor whereby he was to ship the lime at a uniform rate of not less than 40 nor more than 125 tons per week, as directed by the chemist in charge of the water purification works. As soon as it was received the lime was sacked, 90 pounds to the sack, by the workmen at the purification works, and it was planned to regulate the lime supply and shipments so that the lime could be used as soon as received.

The amount of lime necessary to soften the water changes from day to day, and during flood times or after heavy rains the hardness of the river water drops from 300 to 400 parts per million to 100 to 150 parts per million. These changes sometimes occur in less than four hours' time. Consequently there were often six or seven cars of lime on the siding at the plant or in transit in excess of that which could be consumed. Some of these cars were held as long as two weeks before being unloaded because there was no available space to store the excess material.

This condition of affairs resulted in a loss to the city, first because of the demurrage on cars, and second because the lime air slaked and lost strength. The cost of sacking and weighing the lime was high. It required five men working nine hours to sack and weigh a car of lime containing 20 tons; and after the lime was sacked it took from one and a half to two hours to elevate the lime to the third floor of the head house, where it was again lifted by hand to the lime slakers. The work of sacking lime from cars also proved to be a very disagreeable job, especially in hot weather, on account of the lime dust slaking on the sweaty hands and faces of the men. The slaking of the lime dust often resulted in severe burns.

The storage capacity for lime having become inadequate and the method of handling being unsatisfactory, the writer and Mr. C. J. Clarke, engineer in the Water Works Department, were instructed to prepare plans and specifications for new equipment for handling lime. After the plans were drawn they were checked and helpful suggestions were made by Mr. R. S. Jones, civil engineer of Columbus. A brief description of the plant as finally adopted follows:

The equipment consists essentially of a concrete bin, elevated on columns over the railroad tracks located between the head house of the water purification works and sedimentation basins; a V-bucket conveyor and elevator for elevating the lime to the level of the head house roof; a screw conveyor for conveying it across and into the head house, where it is dropped into tanks; and three scales for automatically weighing and dumping the lime into the old slaking tanks below.

The storage bin consists of a concrete hopper 25½ feet square with bottom slopes of approximately 38 deg. with the horizontal, heavily reinforced to take the direct pull due to the weight of the lime and the horizontal thrust due to the bulging effect. The main weight is carried on four reinforced concrete beams, supported in turn by eight columns with flared footings, which take bearings on the solid gravel under the track bed. The center column takes part of the load of the hopper and is cored inside with an 18 in. square opening used as a chute to reclaim lime from the storage bin and deliver it by means of the elevator and conveyor to the tanks in the head house.

The lime may be taken directly from the cars to the tanks without passing into the storage bin. The storage bin has a capacity of 220 tons of lime, or about 22 days' supply, which gives ample storage for any emergency.

Conveying Equipment.—The conveying equipment consists of a continuous V-bucket conveyor and elevator with a capacity of 50 tons per hour, running in a concrete trough between the tracks and through chutes each side of the bin, so that it is enclosed throughout its entire length. The lime is discharged from this elevator into a 12-inch screw conveyor which extends into the roof of the head house and discharges into the top of three tanks which are supported on the third floor of the head house on angle columns and extend through the ceiling into the roof space above.

The V-bucket conveyor and the screw conveyor are operated by an 18 h. p. Westinghouse direct current, 220 volt motor, situated in the roof of the storage bin. The tanks are constructed of ¼-inch steel plate, are 8 feet square, with hopper bottoms, and have a combined capacity of approximately 22 tons, or about two days' supply.

Lump lime, averaging about 2-inches in size, is fed from the tanks into automatic weighing scales, which automatically weigh the lime into the slaking tanks. The slaked lime discharges from the slaking tanks into

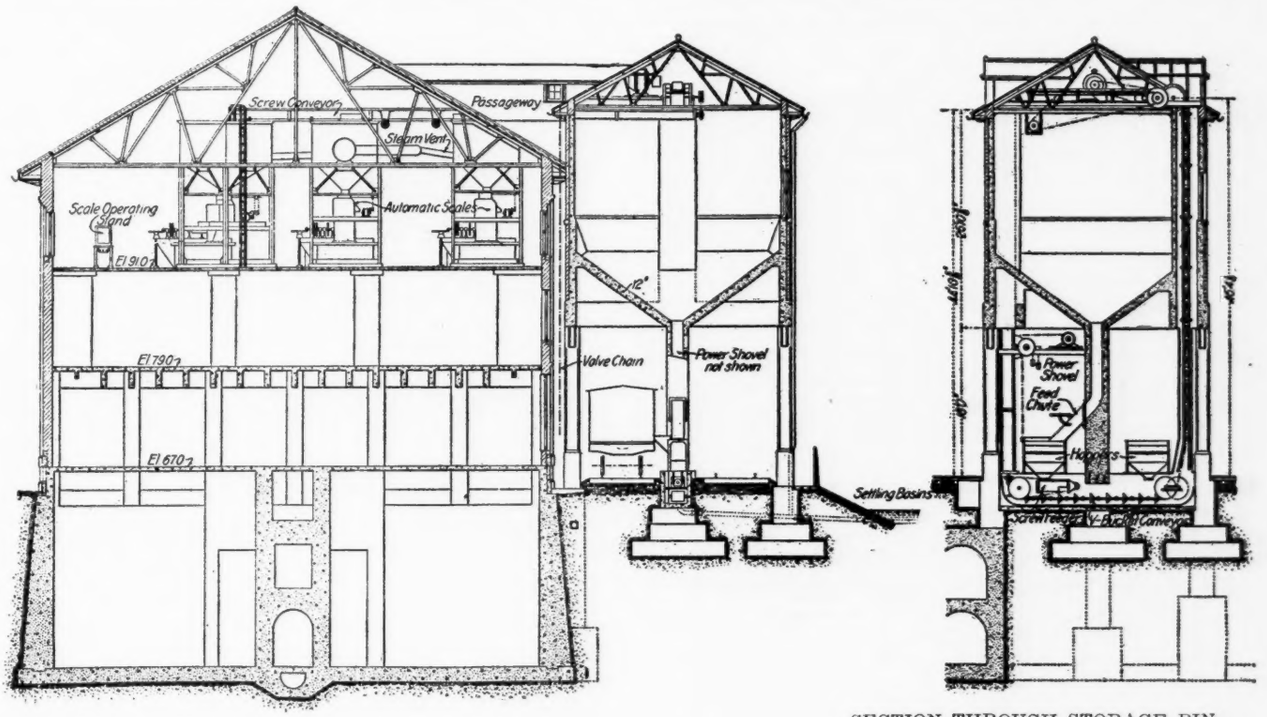
the lime solution tanks below. Milk of lime, of required strength, is made by the addition of water. The milk of lime is kept well stirred by means of paddles and jets of compressed air and is measured into the water by a chemical feed regulator. Later it is planned to pipe the slaked lime directly from the slaking tanks into the water, thus by-passing the lime solution tanks and the chemical feed regulator.

Automatic Scales.—The three automatic scales are alike. Each is built on the equal balanced-beam principle. On knifed edges at one end of the scale beam is suspended the weight hopper and at the other end of the beam, also on knife edges, is suspended the weight box or pan, in which are placed U. S. standard weights to the amount of 75 lb., when that quantity is desired to be weighed. If a 100 or a 150 lb. weight is required, then the actual weight desired to be discharged is placed in the weight box; or the excess of weight over 75 lbs. can be added by a sliding counter poise working on the graduated lever.

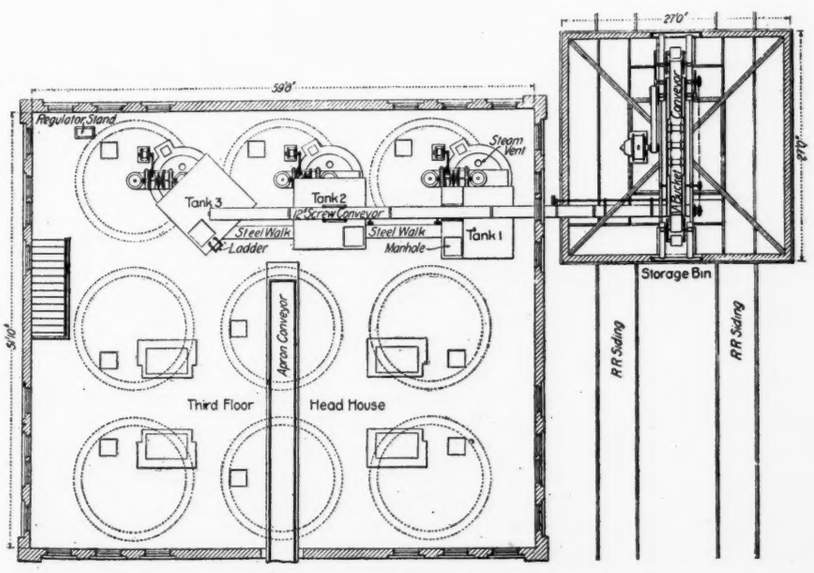
The lime is fed to the weigh hopper of the scale down a sloping chute in which is placed a reciprocating plate feeder to keep the lime from blocking. This feeder is in action only while the scale is filling. It is motor driven by an electric motor and as soon as the scale has received its load the motor automatically stops.

After being fed down the inlet chute the lime passes through a gate of the undercut type. When the weigh hopper has received four-fifths of its load the gate partially closes, the last one-fifth being dribbled into the hopper. When the exact amount has been received into the hopper, the gate closes and is locked by a toggle mechanism. The scale hopper holds the load until it is time to discharge it.

The time of discharge of the three scales is governed by a very ingenious electric clock device specially de-



SECTION THROUGH STORAGE BIN.



PLAN AND SECTIONS OF LIME STORAGE BUILDING.

signed for this job. The scales are connected electrically to the clock and so arranged that one, two or three scales may be discharged as desired merely by throwing in the corresponding switches. Supposing Scale No. 1 is required to discharge 100 lbs. every minute; it is set to weigh exactly 100 lbs.. and a minute disc is placed on the clock face. At every one minute interval the clock movement closes a switch which is connected to the scale by means of a solenoid; this solenoid discharges the scale by allowing the weigh hopper door to open. After discharging the load the hopper door closes again and locks itself. In doing so it opens up the inlet gate and automatically starts another weighing, which will be discharged at the right time. The clock can be set to weigh any number of discharges, from 60 per hour down to one per hour.

Each scale is equipped with an automatic stop counter device, so that when a certain quantity of lime is required to be weighed into the slaking tank the counter is set to the number of drafts required, and when that quantity has been weighed the scale will stop automatically. The scales are very accurate, much more so than any hand weighing methods. They were obtained from the Richardson Scale Company, of Passaic, N. J.

In order to get rid of the steam arising from the water in the slaking tanks, pipes are connected to a suction fan, which draws nearly all the steam away from the scales. To prevent dust and steam from clogging the operating levers of the scales, all of the levers are placed outside of the scale proper, which is enclosed in a heavy cast iron dust-proof casting. All of the pins in the scales are made of phosphor bronze and the bearings in which these pins work are bronze bushed, so there is no chance for corrosion to affect accurate and continuous work. The clock device is arranged in a dust-proof, lock-up casing, with glass doors, thus preventing tampering with the equipment.

Unloading Lime From Cars.—A power shovel for unloading lime from cars into the hopper of the conveyor is located just under the storage bin and supported on the columns. It is operated by a separate 5 h. p. 220 volt Westinghouse motor, and has unloaded a 40 ton car in about three hours, two men being necessary to do the unloading. The total contract price for the bin and all equipment complete was $17,580. Extras to the approximate amount of $1,393.00 were allowed.

The new installation was put in service Feb. 5th, 1913, and it has operated successfully from the start.

Cost Of Operating.—A cost system is kept at the plant and the cost of every job or operation is known. A comparison of the cost of unloading, sacking and dissolving chemicals during the year 1912, the year before the new equipment was installed, and the cost of handling chemicals during year 1913 with the new equipment, is of interest.

In 1912, 5,774 tons of chemicals were used and 28,166 hours of labor are charged against the handling of this material or 4 hours and 53 minutes for each ton of material handled.

In 1913, 7,234 tons of chemicals were used and 24,357 hours of labor are charged, or 3 hours and 22 minutes for each ton.

This represents a saving of 1 hour and 31 minutes on each ton of chemical handled. At the present time the labor cost of handling chemicals amounts to approximately 36 cents per hour, so that the saving of 1 hour and 31 minutes is equivalent to approximately 55 cents per ton.

Figured on this basis the saving effected during the year 1913 by the introduction of this new equipment amounts to $3,978.70.

The water consumption is increasing year by year and therefore the quantity of chemicals to be handled is also increasing, so that the new storage and handling equipment will effect a larger saving in the future than it has in the past, because with this equipment the present force of labor will be able to handle even more chemicals than they now do, whereas before every increase in tonnage necessitated an increase in the labor force.

During the year 1913 the operating expenses for water softening and purification were: For labor $23,760.13; for chemicals, $69,999.06; for general supplies, $7,168.36; a total of $100,927.55. This averages $15.11 per million gallons of water treated. These costs were higher than in 1912 because the water was harder, and consequently more chemicals were required to soften it (7,252 tons were used in 1913 as compared with 55,796 in 1912); more water was pumped and higher wages paid for labor.

TRENTON WATER WORKS

Uses Hypochlorite Temporarily While Filtration Plant Is Being Constructed—Cleaning Mains—Stopping Leaks—Auto Trucks—Testing Laboratory.

Commission government was adopted in Trenton, N. J., in 1911, the Board of Commissioners taking office on August 22 of that year. They have published a pamphlet giving a summary of their conduct of the affairs of the city up to the beginning of this year, which they call an "efficiency report." Possibly the most important and interesting changes which they have made have been in the fields of street cleaning and refuse disposal, and the water supply system. The former we have discussed at some length during the past few months. The following statements concerning the water supply are abstracted from the commission's efficiency report:

The question of obtaining a pure and unlimited supply of water was one of the first things to demand the attention of the commissioners. After a study of all possible sources it was decided that all requirements would most nearly be met by using the water from the Delaware river, and filtering the same with rapid sand or mechanical filters. Messrs. Johnson & Fuller, of New York, prepared the plans for a plant having a daily capacity of thirty million gallons, and this plant is now in course of construction, and it is expected that it will be in operation before the end of this year.

The board did not wait for the completion of the purification plant, however, as the typhoid death rate attributed to the water supply demanded immediate attention; and at the suggestion of the State Board of Health it began treating the water with hypochlorite, which treatment is being continued and will be continued until the filtration plant goes into operation. It is also proposed to provide for the use of hypochlorite in connection with the filtration plant whenever conditions may seem to make it desirable; but the amounts used will be only about one-fourth as great as at present. The quantity now used is about 15 pounds of hypochlorite per million gallons of water, and this has very considerably reduced the typhoid rate, the rate in 1913 having been 76 per cent less than in 1911.

The filtration plant will comprise sedimentation tanks, filter beds and clear water chambers. The cost of the plant will be about $330,000. It is expected that this plant will reduce the bacterial content of the river water by 98 to 99 per cent., and that by using about 4 pounds of hypochlorite per million gallons of water practically all of the remaining 1 or 2 per cent of bacteria will be removed.

In anticipation of having filtered water for distribution, the commission has been carrying out a general cleaning of the pipes of the distribution system, which in some cases have been found at least half full of mud deposits. Up to the first of this year about twelve miles of mains had been cleaned, and about as much more remained to be done. It was proposed to thoroughly clean the reservoir also, and pipes and valves have been arranged, making a by-pass around it so that water can be furnished by direct pumping while the reservoir is empty and being cleaned.

An investigation has been made to discover leaking mains and waste by consumers. There are several points at which mains pass under the canal and creek, and pitometer tests were made of these crossings, which resulted in the discovery of two leaks which were wasting half a million gallons daily. Recent investigations of hopper closets have shown that in most cases these are either running full head from a ½ inch or ⅝ inch opening, or at best are only one-half shut off. "A very conservative

estimate shows that from 1,500,000 to 2,000,000 gallons of water per day is thus wasted." The only remedy appeared to be to place meters on all properties using such closets. Meters have also been installed in all factories and business places.

The system has been adopted of the putting in by the department of house services from main to curb, which is said to have resulted in better workmanship and a uniformity of curb stops: and, as the services are installed in all streets before a permanent pavement is put down, there is a saving in the tearing up of paved streets.

Auto trucks have been installed to do the carting of the department in place of teams, and there are two of these now in use. The director of streets and public improvements, J. R. Fell, states that these trucks have paid for themselves many times over in saving of time in transporting men and material from one job to another, as well as a saving in carting bills.

All coal used by the city is purchased under standard specifications and is tested at the city's laboratory on delivery. For any deficiency found in quality a corresponding deduction is made in the price paid. Daily tests are made by the laboratory of the river water to ascertain the amount of hypochlorite necessary to apply to insure the destruction of pathogenic germs in the water. The testing laboratory also tests asphalt at the mixing plant and as laid on the street, bricks used for paving purposes, and from time to time chemical analyses are made of ice, whiskies, etc., from hotels and saloons.

WATER WORKS DEVICES*

Selecting Type of Pump—Boiler Room Appliances—Reseating Valves—Recording Gauges—Office Devices.

By E. L. LOOMIS.†

More than four-fifths of all the water plants of the state of Indiana belong to the smaller classes, whose daily pumpages probably average less than one million gallons. As compared with the larger systems, these enterprises have relatively few consumers, limited revenues, and proportionately much higher fixed charges and operating expenditures. Therefore, it is easy to realize that of the problems confronting such utilities, those related to economy and efficiency are of paramount concern. And the smaller the utility, all the greater becomes the necessity for the closest scrutiny into its plant operations for the detection and stoppage of waste, and for the economical conduct of its affairs generally.

So many and varied are the equipments available now-a-days which make for economy that to undertake a minute enumeration and description of them all would much overstep the requirements of this report, not to mention the writer's lack of knowledge as to so wide a range. Only a few items, therefore, will be here considered, chief of which may be cited the pumping machine.

As illustrating an experience in pumping economy you will permit me to state the conditions as existing in our plant at Valparaiso, and to make a comparison of the costs of operating each of our three different types of pumps.

Our pumpage approximates one million gallons per day, pumping direct against a total head of 85 feet. Our principal pump for continuous operations is a cross-compound, condensing engine, with Meyer gear and attached air pumps. Upon acceptance test when we purchased this machine two years ago it showed a duty of 78.57 million foot pounds per 1,000 pounds of steam used, pumping against our usual head at normal load.

Assuming an apparent evaporation of seven pounds of water to each pound of coal, and a total head of 100 feet, with a working duty of about seventy million foot pounds per 1,000 pounds of steam, this machine will pump and deliver one million gallons of water each day for one month at a steam consumption of 358,071 pounds, thus requiring 25.57 tons of coal, which, at $3.50 per ton in bin, costs us $89.49. With our No. 2 reserve pump, of the non-compound, condensing, crank and fiy-wheel type, assuming a working duty of only fifty million foot pounds, which really is a trifle too high, for the same pumping operation, 501,300 pounds of steam would be consumed, requiring 35.80 tons of coal at a cost of $124.30. With our third unit, a simple duplex pump, which, needless to state, is rarely placed in service, 752,-129 pounds of steam would be used, or 53.71 tons of coal, costing us $187.98.

Thus is it observed that by using our No. 1 pump, for each month we operate, we show a saving of $34.81 over pump No. 2, while over pump No. 3 we effect a saving of $98.49, or in round numbers at the rate of almost $1,200 per year.

Such a saving to any small plant in a comparatively short time would be sufficient to buy and install the very best and most economical type of pump which the market affords.

In our own case it is plainly apparent that from the standpoint of even ordinary business economy we had better consign both of our low duty pumps to the scrap-pile rather than place them in continuous operation. As auxiliary units, for temporary emergency purposes, however, they, of course, have their proper place and value.

The pumping machine for every plant should be designed so as to give the best possible economy at the normal load, but with ample capacity for the maximum requirements, such as the sudden opening of large connections, or where direct fire pressure is furnished at the hydrant nozzle. In most all cases operating economy should be considered in making a selection rather than first cost. But the fixed charges on a high duty machine of the Corliss type, by reason of its higher first cost, the greater housing space required and its many complications, may sometimes more than counterbalance the saving over a simpler type, such as the Meyer gear.

The kind of boilers, the character of fuel, and methods of firing are all-important questions in considering boiler room economies. For every plant the boilers should be in duplicate units, and, like the pumps, of ample capacity for the peak load, though not too large for the normal uses. As safeguards, the steam lines from the boilers to each pumping unit should be as nearly separate as possible. Obviously also should the boiler feed-water systems be entirely separate and independent.

In determining the kind of coal to be used it has been our experience that dependence should not be placed upon the basis of heat units alone, but that the coals should be tried out, not merely for a few days under the most favorable firing conditions, but thoroughly tested under the every-day working conditions just as they actually exist. Under such test, the coal evaporating the most water for the dollar manifestly should be the kind to adopt. Moreover, with propriety, and sometimes with profit as well, coal bought on contract may be tested from time to time as a check upon its continued good quality. For this purpose where the amount consumed will not warrant the purchase of a good bomb calori-

*Abstracts from paper before Indiana Sanitary and Water Supply Association.
†Superintendent Valparaiso Home Water Company.

meter, the lead oxide reduction method may be used, such an outfit costing but a few dollars and the results being sufficiently satisfactory for purposes of comparison.

Where the coal storage room is located adjacent to railroad siding, if used in quantities sufficient to justify, coal conveying machinery may effect a substantial saving over the usual hand operations.

As aids in the work of full conservation, involving, as it does, one of the most conspicuous items in operating costs, the best patterns of shaker and dumping grates, and also automatic damper regulators, may be used with profit. If the amount of coal consumed will not justify the purchase of a CO_2 recorder, a boiler efficiency meter with Orsat apparatus will be found to furnish a valuable guide.

Steam flow meters may be had at small cost for attachment to the different steam lines, and when installed will furnish desirable information as to the amount of steam conveyed to the different units or heating systems. Another device of value, though of much greater cost, is the Venturi meter, which, if placed on the pump discharge line as a check on the engine counter, will often reveal unsuspected pump slippages needing correction.

A common and often unconsidered source of loss in many small plants is leaky valves. A valve reseating machine should be in every power house and by its use every valve kept always in proper repair. Suitable equipments for the various repairs common to all plants from time to time are not only necessary but money-saving assets in times of their need.

Oiling arrangements frequently are not given the attention which their importance would seem to deserve. The system employed should be such that the oils may be saved, refiltered and used again. With such saving they may be used more freely than otherwise, thus safeguarding against hot bearings from time to time, with their consequent annoyance, or possible interruption to the service.

In connection with the operation of filtration systems, a good serviceable laboratory would seem to be indispensable for the necessary tests. Cities without such systems and having water at times of questionable quality will find apparatus for the use of hypochlorite of lime to be an inexpensive as well as most valuable acquisition.

By the use of steam and water pressure recording gauges, if supplemented with accurate hourly notations of coal consumed and water pumped, the engineer and manager are afforded definite knowledge concerning the workings of the plant, and also furnished a permanent record of the same.

So well known is the value of the water meter that it would seem to be superfluous to make mention of it here. And yet the fact remains that in Indiana there are a number of plants operating almost, if not entirely, upon flat-rate bases. As a conserver of water this device is second to none, and its value is closely followed by the meter testing machine. For leakage inspections the detectorphone and pitometer are both widely recommended.

For the office there are many devices worthy of adoption and use, such as the adding machine, the typewriter, addressograph, card indexes, filing apparatus, loose-leaf systems, etc. An accurate map showing definitely the location of all mains, valves and service boxes is of inestimable value and should be deemed an indispensable part of every system. A few well-selected technical books and the best waterworks journals will prove to be not only sources of information and pleasure, but of actual profit as well. For articles of especial interest, should one wish to dispense with indexes, a scrap-book might be used to good purpose.

PERMUTITE AND ALLAGITE PURIFICATION

Theory of the Action of These Substances in Removing Temporary and Permanent Hardness, Iron and Manganese—Their Composition and Use.

By DR. ROBERT GRIMSHAW.

As is well known, the hardness of water is in proportion to the lime salts and magnesia salts dissolved therein. We distinguish between temporary and permanent hardness. Temporary hardness is due to the presence of dissolved bicarbonates of lime and magnesia which, when the water is boiled, are changed to insoluble carbonates, which then are precipitated. Any remaining hardness is the result of dissolved sulphates of lime and magnesia, which, when the water is boiled, remain in solution therein.

For the removal of the salts of lime and magnesia (which are undesirable for boiler feed water) there has been used for over forty years the well-known lime and soda process, which, however, has the disadvantage that the chemicals added to the water must be varied according to the changing composition of the water; so that success is in great measure dependent on skill and care in tending the apparatus. A further disadvantage of the lime-soda process is that the remaining hardness often leads to deposits in the boiler, which have injurious results. Even when they are only in the form of mud they can be injurious, for instance they can stop up the water glass, cut the valve-seats and cocks, etc.

Recently two new processes of water purification, which are essentially different from those hitherto known, have been devised. They are known as the "Permutite" and the "Allagite" processes. Both are based on the properties of certain substances to absorb the hardening elements (lime and magnesia) in the water and to give up to the water a harmless substance, soda.

As far back as 1850 the English scientist Thomas Way published a paper in which he showed that strong clay soil had the property of decomposing certain salts in such a manner that their basic components are held by it, while the acid components remain in solution in the liquid. According to the assumption of Way, this property of the soil is due to the presence of natural hydrous silicates of aluminum; the so-called "zeolites." Since then a number of other investigators have busied themselves with the remarkable property of these bodies to withdraw bases from aqueous solutions. But at first their work could not be made of practical use in the industries, because on the one hand natural zeolite was not to be found in sufficient quantities, and on the other hand, there was no process known by which zeolite could be made artificially in sufficiently large quantities to make it pay commercially.

This void was, however, filled a few years ago by Dr. Gans. In testing several natural zeolites he discovered that, as regards their ability of taking up bases from aqueous solutions, they had very different properties. Based on these discoveries Dr. Gans classified the zeolites into aluminous silicate and double silicate of alumina. In the first class he placed such zeolites as hold their exchangable bases combined with alumina; assuming that in the case of the double silicates the replaceable bases were combined with silicic acid.

He endeavored, then, to produce an artificial product which should be practically available, by making artificial chabasite, which in nature belongs to the group of alumina silicates. This artificial product is manufac-

tured by melting aluminous minerals or silicates or aluminates with alkaline silicates, or with an alkali, or with an alkaline carbonate, with the addition of quartz or of a quartzoze rock, in such quantities that all the alkali is combined with the silicic acid and the alumina.

On a commercial scale this product can be made by melting together three parts of kaolin, six of quartz and twelve of sodium carbonate. The resulting melted mass is made into a lye with hot water, for the purpose of hydrating it and removing any soluble silicates. By washing and handling in a centrifugal, the remaining granular material is freed as far as possible from the final alkaline lye, then stored in a moist condition. In this manner there is formed an artificial aluminum silicate, which is put on the market under the name of "permutite," in the form of white, sometimes granular, sometimes lamellar crystals. This artificial product possesses in a high degree the property of taking up lime and magnesia from aqueous solutions, and replacing them with a corresponding equivalent of sodium in solution.

Softening the water by the aid of permutite is effected by passing it slowly through filter beds of the permutite. In its passage through the permutite the water gives up to the latter its entire contents of dissolved lime and magnesia, in exchange for which the permutite yields up to the water the correct chemical equivalents of soda. Chemically speaking, the sodium atoms combined with the alumina of the permutite are replaced by lime and magnesia atoms.

The permutite is thus gradually changed from a pure sodium zeolite to more of a calcium-magnesium zeolite. When all the replaceable sodium atoms are supplanted by calcium and magnesium atoms, the peculiar property of the permutite is at an end.

In the practical use of this material, the softening process is naturally not carried so far as thorough exhaustion of the material. On the contrary, as soon as the water shows any traces of hardness (which may be detected by the use of ammonium oxalate or by a soap solution) steps are taken to regenerate the permutite. This regeneration is effected by first freeing the filter from dirt, dust and the like, and loosening its texture by treatment with water, and then passing through it a comparatively concentrated solution of a sodium salt—preferably a solution of common kitchen salt (sodium chloride). There then results the converse reaction to the softening process above described. In the regeneration process the sodium atoms of the saline solution drive out from the permutite the previously taken up lime and magnesia atoms, and take their place. Thus, in the regeneration, the calcium or magnesium zeolite is again transformed into a sodium zeolite, that can be used again for water softening as at first described.

By reason of the possibility of regenerating and reusing the permutite, the duration of that material is (in theory at least) infinite. In practice, however, the conditions are not so favorable, as the permutite is gradually decomposed; but the products of decomposition are partly removed in the washing process.

For softening acid water, permutite is not directly suitable, as it would be decomposed by the carbonic acid in the water. It is therefore necessary to remove the carbonic acid before the treatment with permutite; this may be done, for example, by filtering the water through marble. Whether or not a thorough removal of the carbonic acid results thereby is, however, doubtful.

While Dr. Gans manufactures artificial zeolite as a crystalline-lamellar substance and makes its property of exchanging atoms of practical use in purifying water, Kobelt, the inventor of the "allagite" process, takes another route. He made experiments as to whether besides the long known natural zeolite there were not other natural products which have the property of readily exchanging or replacing their bases; and found that the so-called "rock glass" or volcanic glass, also, operated in this manner. This, however, does not exist in already available condition, but must first, by a mechanical process, be purified from its inefficient by-materials. The material, separated from volcanic rocks by a simple process, is put on the market under the name of "allagite" and consists of a dark brown porous mass with grains about one millimeter (0.04 inch) in diameter. Chemically it differs from permutite in that, while the latter is a true chemical compound, allagite may be considered as a so-called permanent solution.

Recent experiments go to show that the rock glasses are neither chemical compounds nor zeolites. A simple experiment with muriatic acid proved this. Zeolites are compounds containing fluoric acid, alumina, water and metallic acids; they have in common the property of decomposing under the action of muriatic acid, liberating a silicious jelly. Permutite also has this property; it being, according to the most recent data, an aluminum silicate of the zeolite group. Allagite, on the other hand, is not attacked by muriatic acid and remains thoroughly indifferent; it is also much harder than the artificial melted permutite.

The method of using allagite for softening water is the same as that described for permutite. The same is true as regards its regeneration, which is effected by treatment with a 4 to 5 per cent solution of common salt.

But from another point of view the new softening processes are far in advance of the usual lime and soda method. In the textile industries (as silk dyeing) in laundries, etc., these two materials do away with difficulties where other processes do not. Outside of softening the water, they can remove iron and manganese. Most surface water contains iron in the form of dissolved oxide compounds; usually carbonates and sulphates. If the water comes in contact with the air, the dissolved iron precipitates and leaves the originally clear water cloudy and muddy in appearance, and useless for most industrial purposes. Further, the conduits are fouled by the iron precipitates.

Such water has been freed from iron and manganese by aeration by well known processes, but these do not, as a rule, effect perfect deferrization of the water. In particular, water that has in solution iron in combination with organic substances is very difficult to free from that metal. Often the filtration is attended with difficulties. For this reason the permutite manufacturers have put on the market manganese filters which are saturated with higher manganese oxides. By simply passing the water through the permutite filter it is freed from both iron and manganese. The manufacturers suggest first adding to the water, very gradually, a very dilute solution of potash permanganate. This facilitates the formation of fine colloid precipitates of manganese hydroxides, which are favorable to the separation of the iron. The small amounts of manganese introduced into the water by the permanganate are absorbed by the permutite. The precipitated iron collects principally in the upper filter layers, from which it is removed from time to time by washing.

When the manganese filter is exhausted—which occurs when the oxygen of the higher manganese oxide has been taken up by the iron—the filter is regenerated by treatment with permanganate of potash or of calcium. In this regeneration, the lower manganese com-

pounds in the filter are changed into higher oxygen compounds.

"Oxyd-allagite" contains, also, higher manganese oxides, which, in the same manner as above described for permutites, give up oxygen and change the soluble suboxide iron compounds into insoluble oxides and hydroxides, which precipitate.

While the manganese is artificially introduced into the permutite filters, the natural allagite filters already contain manganese; so that allagite is made ready for use as a deferrator and demanganator by simply treating it with permanganates.

If the permutite and the allagite processes are compared, it appears that they give equally good results in softening, deferrating and demanganating water. The allagite process has the advantage, when used on carbonated water, that allagite is perfectly resistant to acids, while permutite is attacked by them.

COST OF NEW YORK CITY'S WATER.

The Comptroller of New York City has recently published a statement giving the more important features and figures relative to the revenues and operation expenses of the city's water supply for the year 1913. The gross revenues from the sale of water in the entire city during 1913 were $12,753,050, and the total operating expenses, including taxes, were $4,622,129, leaving a total operating income of $8,130,921. The interest on the outstanding bonds (not including those of the new Catskill system) was $3,270,452, and the amortization charges thereon $1,534,158. Deducting this from the total income leaves a net income of $3,326,311. No depreciation or obsolescence charges are included, but the amortization charge serves something the same purpose.

Of the operating charges, 7.79 per cent was for administration, 9.27 per cent for collection and storage, 3.70 per cent for purchased water, 0.94 per cent for purification, 37.29 per cent for pumping, 20.53 per cent for distribution, 0.87 per cent for analyzing and testing, 15.16 per cent for water revenue collection, 3.61 per cent for taxes, and 0.84 per cent undistributed. These operating expenses represent 36.2 per cent of the revenues, the other 63.8 per cent representing interest, sinking fund, and any allowance for depreciation or obsolescence.

From 1832 to the end of 1913, the capital expenditures for the water systems in all the boroughs aggregated $194,734,433, for which there are still outstanding bonds to the amount of $89,084,295. It is estimated that the new Catskill supply will add to this cost about $176,000,000, or nearly as much as the cost of all of the water systems serving the several boroughs up to the present time. Up to the beginning of this year, bonds for this system had been issued to the amount of $93,315,623. When the Catskill system has been completed the total interest charge will be $10,840,788 a year; but this will be subject to reduction from year to year as the outstanding bond issues mature and are redeemed.

The comptroller makes an estimate as to the ability of the city to meet this interest charge out of the water revenues. He estimates that by the year 1920 the population of the city will be seven million, and the daily consumption about 700 million gallons. The consumption at the present time is estimated to be 520 million gallons per day. Taking 700 520ths of the present net income of $8,130,922 gives an estimated net income of $10,945,471 in 1920, or $104,683 more than the interest charges. In 1913 the excess of income over operating and interest charges was $712,203. Providing, therefore, that the percentage of operating cost remains stationary until 1920, the excess of earnings over interest charges will vary from $712,203 in 1913, to $104,683 in 1920, with possibly a deficit in some of the intervening years.

WATER WORKS IMPROVEMENTS AT BALTIMORE

Construction of Rapid Sand Filtration Plant of 128 Million Gallons Capacity—Nine-Foot Concrete Pipe Laid in Old Conduit.

Work is well under way on very extensive improvements of the municipal water supply of Baltimore, Md., which are being carried out to filter the existing supply. At present the supply comes from Loch Raven in a 12-ft. tunnel and discharges into a large reservoir known as Lake Montebello. From Lake Montebello it passes by a 12-ft. brick-lined conduit to another reservoir known as Lake Clifton, from which it is distributed to the city. Both of these reservoirs or lakes are at the northern part of the city, within city limits. Advantage is being taken, while constructing the filtration plant, to also increase the effective head on the water supply system by cutting out Lake Clifton and Lake Montebello from the regular distribution system and placing the clear water reservoir about 30 feet higher than the latter lake. The two lakes, however, will be retained as such, and a connection with the distribution system also will be continued but kept closed, and the supply in the lakes will be kept only as a reserve in case of large fires. The lakes meantime, being surrounded by parks, will be very valuable features from a scenic point of view.

The conduit leading from Loch Raven is tapped about a quarter of a mile before it reaches Lake Montebello by a vertical shaft, and a pumping station will be established at this point and the conduit blocked on the lower side of the shaft. Water will be pumped from the conduit to 32 mechanical filters, each of four million gallons capacity. The filtered water will flow to a filtered water reservoir, divided into two basins by a middle partition wall, and from this reservoir will pass by a pipe line to the nearest main highway, Harford avenue, where it divides into two lines, one passing down Harford avenue and the other to Lake Clifton, where it connects with the existing distribution system.

Work on the filtration plant was begun last summer, and the concrete foundation work and side walls of the filters and mixing basin are completed, and the concrete roofing is now under way. Work on the concreting of the coagulating basins also has been started, as has that of the shaft to the Loch Raven conduit, and other details of the work. This work we expect to describe at some length in a later issue of Municipal Journal.

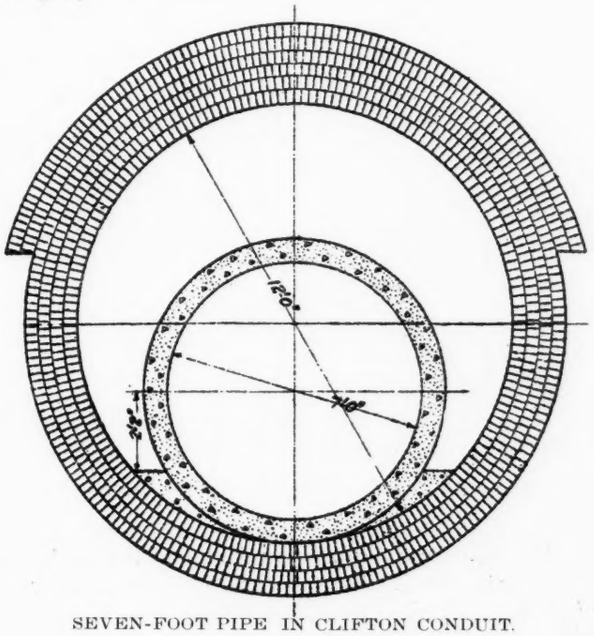
In conducting the purified water from the filtered water basin to the distribution system, the existing conduit connecting Lake Montebello and Lake Clifton is to be utilized, a new line being built for the short distance from the basin to this existing conduit. As stated, this conduit is 12 feet in diameter, is circular and lined with brick, 3 rings thick up to a short distance above the springing line and 5 rings thick over most of the arch. This conduit is not entirely tight, even against seepage of outside water, and it was not thought practicable to use it under the increased head to which it would be subjected. It was also calculated that a smaller pipe would be amply large to carry all of the supply. Consequently, it is decided to place a new conduit inside of this old conduit, one of the important reasons for this being that the entire line is in tunnel, at some places 75 feet or more below the surface, and the construction of a new tunnel or trench would have been very expensive. Also the placing of the new conduit in the old one permits access to the new conduit for inspection and possibly for repairing leaks, etc., without emptying it. The conduit from the filtered water reservoir to where the line bifurcates is to be 9 feet in diameter, and the

two lines from the junction will each be 7 feet in diameter.

Bids were received on December 24 for both steel and reinforced concrete pipes for these lines, and reinforcd concrete being offered at a lower price, this construction was adopted and the work is now under way.

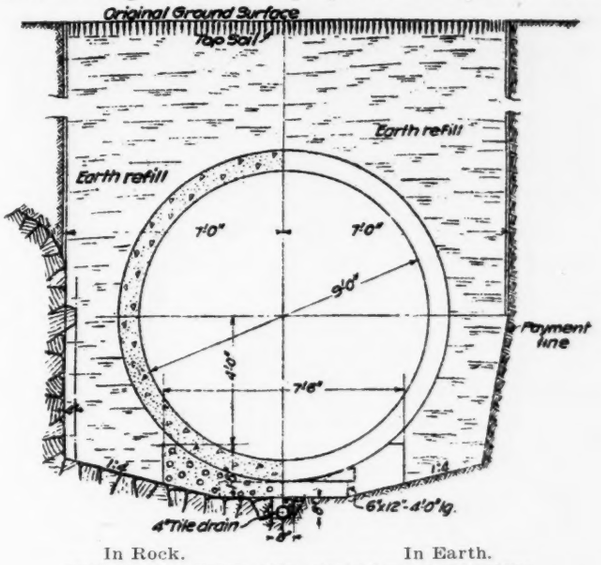
One of the several interesting features about this part of the work is the fact that the new conduit must be installed in the old while the latter is supplying water for the consumption of the city. In order to effect this, water will be allowed to flow from the upper to the lower lake for two days, or so much thereof as is necessary to fill Lake Clifton; the conduit will then be shut off at the upper end and emptied, and the contractor allowed to work therein for two days, or possibly a few hours longer, provided the water is not lowered too far in Lake Clifton. This means that only half of the time can be put in by the contractor on work in the tunnel, and that all work must be left in such condition that water can be turned onto it immediately and allowed to flow over or through it for two days before he can have access to it again. Two shafts are sunk to the conduit and work will progress from each of these. The pipe will be lowered down the shaft and at first carried to a point about midway between two points of access to the conduit, and construction proceed in both directions towards these two points.

As shown by the accompany section, the concrete pipe will rest in a concrete cradle in the bottom of the conduit, except that the contractor expects to block the pipe up 4 inches from the bottom of the conduit and leave the middle of the cradle open to serve as a drain. The concrete pipe is being made by the Lock Joint Pipe Company.



SEVEN-FOOT PIPE IN CLIFTON CONDUIT.

At the present time one of the shafts has been completed and the contractors are working diligently in manufacturing the pipe. Work was begun on this on April 30, and twenty 6-ft. lengths of pipe are being made each working day when the weather permits. These pipes are probably the largest which have ever been made to stand any considerable internal pressure, the maximum pressure to which these pipes will be subjected being 35 pounds. It is required by the specifications that the shell of the 9-ft. pipe be not less than 9 inches thick and that of the 7-ft. pipe not less than 8 inches thick, and these are the thicknesses used in construction. It also requires that the reinforcing steel shall not be stressed above 10,000 pounds per square inch, and the reinforcing has been designed in accordance with this requirement, with additional reinforcement which increases the strength by approximately 10 per cent. As required by the specifications, the concrete is being mixed in the proportion of 1 part of Port-



In Rock. In Earth.

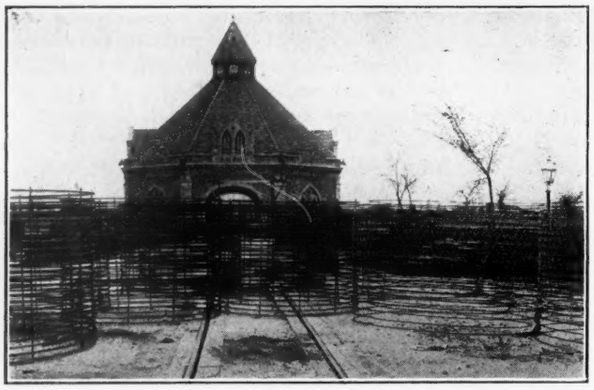
NINE-FOOT PIPE AND CRADLE IN TRENCH.

land cement, 1½ of sand and 2½ of stone not larger than three-quarter inch.

According to the contract, the entire line when completed is to be tested for leakage under a head of from 30 to 80 feet, and, while maintained full under this head, the leakage from the 841 feet of 9-ft. pipe between the clear water basin and shaft No. 2 shall not exceed 4,000 gallons per 24 hours; that from the 5,264 feet which is laid in the conduit, of which 4,123 feet is 9-ft. pipe and the rest 7-ft., shall not exceed 30,000 gallons per 24 hours; and the leakage from the remaining 1,720 feet of 7-ft. pipe, which is laid in open trench, shall not exceed 4,000 gallons in 24 hours. In making the test the full pressure will be maintained for a period of 48 hours.

In order to provide for expansion and contraction in the pipe laid in open trench, a ring of 16-gauge copper plate, with a crimp in the middle which will allow it to increase and decrease in width by the bending of the crimp, will be fastened with one-half in the spigot of a pipe, with the crimp resting in the face. A wide opening will be left between the end of the spigot and the shoulder of the bell at each joint, to be filled with concrete after the pipes are in position, the longitudinal reinforcement extending from the bell into this open space and the other half of the copper expansion plate extending across from the other direction. Thus, when this opening in the joint is filled with concrete after the pipes are in place, this new concrete will be bound to the bell end by the reinforcing rods, and will also embed one-half of the copper plate; therefore, should any contraction take place, the new concrete carrying one-half of the copper plate will be tied to the bell end, while the other half of the copper plate will be embedded in the spigot end, and the copper plate will serve as a metallic dam to cut off any leakage of water through the crack formed by contraction.

The more important prices of the accepted bid were as follows: Earth excavation in trench, $1.55 per cubic yard, there being estimated about 19,000 cubic yards; 9-ft. pipe in trench, $21.50; 9-ft. pipe in conduit, $22.50;



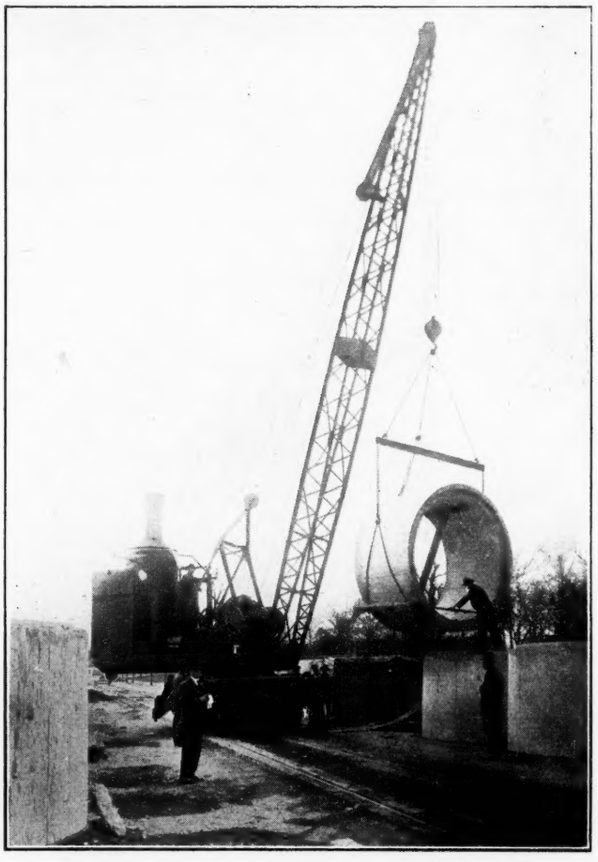
PIPE REINFORCEMENT, BOTH BAR AND WIRE.

7-ft. pipe in trench, $16.50, and the same in the conduit. The concrete used in the cradle will be paid for by the cubic yard at $10 a cubic yard, this being mixed of 1 cement, 3 sand and 6 broken stone.

Each one of the 9-ft. pipes weighs 22,000 pounds, and special machinery is required for handling this weight. The contractor is manufacturing the pipe at two points. The larger part is being made near Lake Clifton, immediately over the existing conduit. A standard gauge track has been laid here leading to the working shaft, and the pipe is being made on each side of this track at the end furthest from the shaft and the finished pipe being deposited near the shaft. A locomotive crane manufactured by the Interstate Engineering Company travels on this track and carries the pipe from the point of manufacture to where it is temporarily deposited; while a smaller locomotive crane of English make is used for handling the forms, reinforcement, concrete and other lighter materials.

In manufacturing the pipe, a cast iron base plate is set level on the ground, and two rings of reinforcement which have previously been bent and wired to exact shape are set in place on this, being held in position by special grooves and other contrivances. The inner and outer forms are then placed, these being made in sections which are fastened together by simple latches. All edges of the forms are carefully machined so as to make almost absolutely watertight joints and prevent the loss of liquid cement from the concrete. Round 1-inch bars are set vertically between the forms and the reinforcement to hold this at the proper position in the pipe while the cement is being poured. As the cement is poured and consolidated, these spacing bars are gradually raised until entirely withdrawn. On top of the center form is placed a circular platform on which the laborers stand while tamping the pipe, and it also receives the concrete. The concrete is brought by the smaller locomotive in bottom dump buckets and discharged onto this working platform and from this shoved by a sort of hoe into the annular space between the forms, and is then thoroughly tamped by the laborers while waiting for another bucket of concrete to be brought. This is continued until the form has been completely filled. The first bucket contains mortar without any stone, which is well tamped into the bottom of the form to form the bell; and similarly the spigot at the upper end is formed of mortar without any stone. When one pipe has been completed, the working platform is lifted by the locomotive crane and dropped onto another form, which has meantime been set up, and the process repeated.

The pipes are made within a foot or two of each other in two parallel rows, and at night an enclosure of planks, which are permanently fastened together in sections, is placed around the pipes leaning against the moulds, and canvas thrown over the top of the whole, and a steam pipe carried down the middle between two rows of pipes. This pipe has a slot on the underside through which steam escapes into the enclosed space around the pipes, and this steaming is continued all night, holding the temperature at 150°, thus hastening the set. In the morning, while the lighter derrick is engaged in setting up the forms and carrying the concrete for manufacturing pipe, the heavier derrick is used for transporting the pipe which was made the previous day to another position, where it is allowed to rest on its side for about two weeks to obtain a thorough set before being lowered into the tunnel. Very simple but ingenious appliances are used for lifting the pipe from the forms, for turning it onto its side, and for carrying it in a sling which allows it to be deposited upon the ground without in



HANDLING PIPE 24 HOURS AFTER POURING.

TAMPING PIPE IN FORMS.

any way interfering with the removal of the sling afterward.

The reinforcement is in two rings, one of ¾-inch bars manufactured by the Corrugated Bar Company, and the other of wire mesh manufactured by the American Steel and Wire Company. The wire mesh is bent to shape around six vertical posts which give it the exact size, and is wired together in this form, then lifted vertically from its position around the posts and placed at one side until needed. The ¾-inch reinforcing comes in bars cut to the proper length, and these are bent to the proper radius on the ground by a very simple machine. These rings are then fastened on vertical rods, a contrivance being used which makes it impossible to use any other than the right number of rings or to make the spacing of them non-uniform. Rings and rods are all wired together with soft wire.

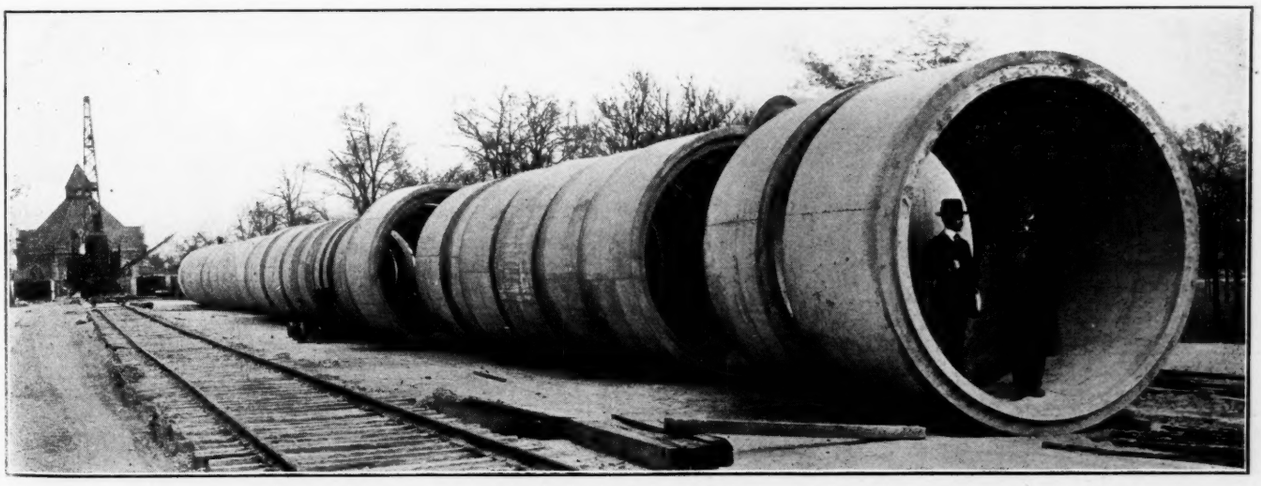
In mixing the concrete, a small batch mixer having a nominal capacity of 5 cubic feet, and known under the trade name of the "Little Wonder," is used. The unusual system of mixing is employed of first introducing the proper amount of water into the mixer, into which is emptied one bag of cement, then 2½ cubic feet of stone, and when this has been thoroughly coated with the cement, the 1½ cubic feet of sand is added. This mixer gives a perfect inspection of the materials during the mixing, and this is continued until the mixture is perfectly homogeneous, when it is discharged into a bucket, in which it is carried to the working platforms. In measuring the cement and sand, a sheet iron scoop, closed with a square end and with a spout opening at the other, is provided with a false end which is slipped into position, the whole being so adjusted that when this false end is in position the capacity of the scoop is just 1½ or 2½ cubic feet, as the case may be. When the scoop has been filled and the top struck off to secure perfect measure, the false end is lifted out and the scoop, which is on a wheelbarrow frame, is wheeled up the runway and discharged into the mixer. One man on the sand, one on stone, and one at the mixer who operates the mixer and puts in the water and cement, are said to turn out 30 cubic yards a day. There are two mixers and two gangs working continuously.

One of the lines of 7-ft. pipe is in trench varying from 10 to 18 feet deep, about half of which has been completed. This trench, about 10 feet wide in the clear, is being excavated largely in sand and fine gravel, and a drag scraper is being used for this purpose. The front end of the trench is sloped at an angle of about 30 degrees, and at the front of this, as a continuation of the slope, is a wooden traveler which carries a plank floor incline at an angle of 45 degrees. The scraper is dragged up this plank floor and at the top discharges the excavated material into a chute, which in turn discharges it into a cart which stands at the lower end of the chute and alongside of the traveler. The traveler is, of course, moved ahead as the excavation progresses. A cable from the front end of the scraper passes to the top of the incline, through a snatch block at this point, back down the incline, around a drum and back to the other end of the scraper. By reversing the motion of the drum, the scraper is either carried up the incline with the full load or brought back empty. Plank sheeting is used in this trench, and is being driven partly by hand mauls and partly by a light steam-hammer pile driver. The latter is, of course, specially advantageous in a soil of this nature where a continuous succession of light blows would cause a penetration while a large part of the energy from a heavy blow would merely go into a rebound, and only a small part into actual penetration of the soil.

Repairing Meters.

In the course of a year the water department of Lancaster, Pa., repairs or cleans about 300 meters of the 4,300 in service. It takes them out and resets them, charging for both repair parts and labor. Superintendent E. K. Saylor recommends that the department furnish the labor free and charge for repair parts only. Says he: "From data gathered from other cities as to meter repairs there is only one place in ten that makes any charge for repairs to meters as to labor, and the popularizing and care of meters in an economical manner by the department, and without much cost to the consumer, naturally will lead to an increase of metering in the city. This in turn will stimulate the householder to put in good plumbing and to keep in repair the old plumbing.

"The amount of repairs depends very largely upon the make of the meter in use, the quality of the water, the character of the settings and the accuracy of registration to be maintained. It is highly important at all times to keep all meters in good repair, so that accurate registration may be shown, as this is equally fair to the city and to the consumer. A low repair cost at the expense of accurate registration is of course poor economy."



COMPLETED PIPE.
Construction track at left; pipe handling crane at background.

WATER WORKS STATISTICS OF AMERICAN CITIES

TABLE NO. 1—CONSUMPTION AND GENERAL. MUNICIPAL.

City.	Cost of plant.	Population. Total.	Population. Supplied with water.	Consumption. Total, gallons.	Consumption. Maximum daily, gallons.	Consumption. Method of obtaining figures.	Consumption. Passed through meters, gallons.	Furnished free. Gallons.	Furnished free. Method of obtaining figures.
Alabama:									
Mobile	$1,961,143	75,000	65,000	3,984,551,523	10,916,000	.....	.....	.....	.....
Talladega	85,000	6,000	3,000	109,500,000	350,000	Estimated	.....	.....	.....
Arizona:									
Globe	200,000	9,000	6,000	119,013,877	350,000	Pump counter	All	No record	.....
Arkansas:									
Fayetteville	225,000	6,500	5,500	180,000,000	.....	Meter	One-half	10,000,000	Estimated
California:									
Lodi	50,000	3,600	3,000	216,000,000	1,400,000	Estimated	1,050,000	None	.....
Los Angeles	.....	500,000	390,000	18,200,000,000	63,800,000	Meter & pump counter	.....	.....	.....
Oxnard	107,000	4,000	4,000	.....	8,000	Pump counter	.....	None	.....
Redlands	500,000	12,000	12,000	1,304,000,000	4,800,000	Weir at pumping plant	.....	Fire only	.....
San Diego	5,210,520	80,000	80,000	2,503,962,800	12,264,871	Venturi meter	2,106,603,059	None	.....
Tulare	110,000	3,300	3,000	Not known	1,500,000	Venturi meter	Not known	None	.....
Whittier	75,000	6,200	6,500a	814,016,000	Domestic est.	.....	.....	.....	.....
Colorado:									
Colorado Springs	3,179,797	33,500	33,000	2,459,937,000	11,802,000	Meters on supply mains	15%	860,734,750	Estimated
Fort Morgan	120,000	4,000	4,000	178,868,000	1,250,000	Estimated	None	25%	Estimated
Golden	165,000	2,400	.....	.....	.....	.....	.....	.....	.....
Grand Junction	600,000	9,000	9,000	.....	.....	Standard weir	.....	.....	.....
Greeley	500,000	9,000	11,000	900,000,000	3,200,000	Estimated	.....	50,000,000	Estimated
Silverton	60,119	2,153	2,153	.....	.....	.....	87,810	.....	.....
Montrose	120,000	3,500	4,000	170,000,000	750,000	Estimated	.....	b.	.....
Connecticut:									
Bristol	500,000	15,000	10,000	447,000,000	1,600,000	Venturi meter	60%	6,000,000	Estimated
New Britain	3,000,000	50,000	49,500	1,708,340,700	3,803,700	Meter	1,388,340,700	350,000,000	Estimated
New London	1,249,118	20,000	19,400	1,133,300,000	4,000,000	Venturi meters	418,411,500	183,000,000	Estimated
Putnam	265,000	8,000	7,000	223,805,053	621,681	Pump counter	33%	None	.....
Southington	269,572	7,000	4,500	200,000,000	550,000	Estimated	63,000,000	None	.....
South Norwalk	610,448	10,000	12,500	533,720,000	2,284,161	Meter at filter	220,000,000	Pub. bldgs.	Estimated
Waterbury	.....	80,000	74,000	2,482,813,480	.....	.....	All	.....	.....
Willimantic	375,000	11,260	11,200	345,718,956	.....	Meters	All	.....	.....
Winsted	298,254	9,500	9,000	.....	1,500,000	Estimated	116,982,500	.....	.....
Delaware:									
Dover	50,000	4,500	3,000	73,000,000	.....	Pump counters	None	.....	.....
District of Columbia	21,000,000	353,000	343,000	21,000,000,000	75,420,000	Venturi meter and pump counters	6,470,644,300	135,421,600	Measured
Florida:									
Bartow	25,000	5,500	4,000	40,000,000	200,000	Estimated	.....	1,560,000	Estimated
Daytona	68,548	3,000c	2,000c	47,146,280	300,000	Metered	43,357,000	None	.....
Jacksonville	.....	81,000	.....	2,071,491,673	5,675,292	Pump counters	Not known	None	.....
Key West	.....	30,000	Fire only	240,000	2,000	Tell-tale on stand-pipe	None	.....	.....
Marianna	15,000	3,000	2,500	14,500,000	40,000	Estimated	642,000	1,170,880	Estimated
Ocala	42,500	5,000	.....	80,000,000	400,000	Metered	.....	.....	.....
St. Petersburg	116,000	6,000d	90%	188,172,240	515,540	Pump counter	.....	.....	.....
Georgia:									
Americus	100,000	10,000	6,000	186,976,940	1,000,000	Pump counters	48,385,000	38,590,000	Estimated
Augusta	1,000,000	50,000	50,000	3,000,000,000	9,000,000	Pump counters	.....	.....	.....
Bainbridge	45,000	4,500	400	.....	.....	.....	.....	.....	.....
Griffin	82,000	7,478	3,500	101,186,563	450,000	Meters	86,186,560	15,000,000	Estimated
Madison	.....	2,500	1,000	29,200,000	80,000	In clear water basin	10,500,000	18,700,000	Estimated
Statesboro	54,000	3,000	2,500	.....	90,000	Pump counters	.....	.....	.....
Thomasville	.....	7,000	4,000	85,000,000	250,000	Estimated	.....	5,000,000	Estimated
Illinois:									
Blue Island	.....	10,000	9,000	225,000,000	750,000	6-in. meter	2,170,000	10,000,000	Estimated
Bridgeport	43,000	3,000	.....	.....	55,000	Meter	.....	.....	.....
Canton	60,000	13,200	8,000	144,000,000	800,000	Meters & pump counter	132,000,000	18,000,000	Meters
Chicago	.....	2,372,000	2,372,000	188,902,000,000	.....	Pump counters	43,045,000,000	.....	.....
Decatur	1,150,000	35,000	27,500	1,297,941,180	6,000,000	Venturi meter	1,000,000	297,941,180	Estimated
Highland Park	125,000	5,000	6,500	365,000,000	2,000,000	Pump counter	950,000	50,000	Estimated
Hinsdale	.....	4,000	3,000	.....	250,000	.....	225,000	25,000	Estimated
Naperville	.....	3,700	2,600	.....	200,000	Estimated	.....	.....	.....
Rockford	1,055,033	53,000	46,000	1,046,030,270	3,970,000	Pump counters	600,000,250	151,550,500	Estimated
Rock Island	900,000	25,000	24,000	1,138,000,000	4,896,000	Pitometer	227,000,000	25,000,000	Estimated
Salem	65,000	4,000	800	220,000,000	70,000,000	Meters	220,000,000	10,000	Estimated
Taylorville	50,000	7,000	6,000	.....	450,000	Estimated	.....	Fountains	.....

Indiana:									
Auburn	110,000	4,500	3,000	237,250,000	650,000	Pump counter	None	e.	
Bedford	125,000	10,000	.....	350,000,000	.....	Estimated	.....	.....	.....
Butler	50,000	2,000	1,500	.....	.....	.....	.....	.....	.....
Evansville	2,250,000	80,000	55,000	3,575,074,000	12,500,000	Pump counter	.....	273,500,000	Estimated
Lebanon	102,000	6,000	5,000	138,700,000	500,000	Estimated	.....	40,000	Estimated
Logansport	.....	20,000	15,000	.....	6,500,000	Pump counters	None	.....	.....
Portland	.....	6,000	.....	.....	.....	.....	.....	.....	.....
Rushville	85,000	6,000	5,500	1,825,000	5,000	Estimated	.....	‡110,000	Estimated
South Bend	.....	60,000	.....	1,812,656,897	.....	Estimated	.....	.....	.....
Union City	105,000	6,000	5,400	120,000,000	.....	Pump counter	.....	.....	.....
Iowa:									
Cedar Falls	121,652	6,500	6,000	175,984,300	862,500	Pump Counter	49,000,000	.....	.....
Cherokee	66,800	5,000	3,300	55,000,000	175,000	6-in. meter	.....	14,000,000	Estimated
Fairfield	175,000	5,500	3,000	100,000,000	300,000	Pump counter	95,000,000	For fires	.....
Fort Dodge	259,000	20,000	15,000	375,000,000	1,500,000	Pump counter	200,000,000	100,000,000	Estimated
Maquoketa	85,000	3,900	3,200	86,000,000	350,000	Pump counter	.....	2,000,000	Estimated
Mt. Pleasant	.....	3,875	.....	.....	.....	.....	21,248,610	.....	.....
Muscatine	365,000	18,000	10,000	462,000,000	2,000,000	Pump counter	119,000,000	5,000,000	Estimated
Sioux City	856,113	52,000	.....	1,015,039,580	2,780,930	Pump counter	.....	.....	.....
Washington	.....	5,000	.....	.....	200,000	.....	.....	.....	.....
Kansas:									
Cherryvale	155,000	5,400	4,000	174,000,000	1,000,000	Meter	40,000,000	18,000,000	Estimated
Coffeyville	295,717	18,000	15,000	610,300,000	2,800,000	Venturi meter	239,570,000	None	.....
Columbus	50,000	4,000	2,500	50,000,000	150,000	Estimated	24,000,000	5,836,000	Estimated
Houton	87,000	4,200	1,000	21,900,000	75,000	Estimated by stand-pipe	.....	.....	.....
Osawatomie	48,625	5,000	1,050	162,000,000	450,000,000	Estimated	18,000,000	500,000	Estimated
Ottawa	.....	7,700	4,200	279,000,000	1,000,000	Pump counter	.....	1,500,000	Estimated
Pittsburg	283,000	16,000	15,000	436,000,000	1,200,000	Pump counter	180,000,000	.....	.....
Pleasanton	35,000	1,800	800	14,600,000	40,000	Estimated	.....	None	.....
Washington	30,000	1,600	.....	.....	50,000	Meters	.....	Flush tanks	.....
Wellington	200,000	7,000	.....	270,000,000	1,000,000	Estimated	.....	.....	.....
Kentucky:									
Corbin	50,000	4,500	2,500	.....	.....	.....	.....	.....	.....
Louisville	8,900,000	235,000	214,000	9,324,015,041	38,000,000	Plunger displacement	3,935,601,517	Unknown	.....
Owensboro	490,000	25,000	.....	.....	1,500,000	Estimated	.....	.....	.....
Louisiana:									
Natchitoches	5,500	5,000	4,000	45,625,000	.....	Estimated	30,000,000	365,000	Estimated
Maine:									
Dexter	75,000	4,000	3,000	30,000,000	83,000	.....	1,120,000	e.	.....
Gardiner	259,189	10,000	7,000	278,570,000	800,000	.....	.....	.....	.....
Pittsfield	75,000	3,500	2,000	70,000,000	200,000	Estimated	None	b.	.....
Rumford	519,945	6,000	6,000	150,000,000	425,000	Estimated	.....	35,000	Estimated
Maryland:									
Baltimore	.....	595,528	595,528	27,433,782,224	86,916,184	Vent. met. & pmp. c'ntrs.	6,759,014,445	3,650,000,000	Estimated
Chestertown	.....	3,000	2,000	200,000,000	150,000	Estimated	.....	Very little	.....
Crisfield	.....	10,000	1,000	6,000,000	.....	Estimated	.....	.....	.....
Massachusetts:									
Andover	355,255	7,200	6,500	229,000,000	631,000	Meters	.....	.....	.....
Arlington	.....	13,500	13,300	287,008,000	.....	Venturi meters	All	.....	.....
Athol	440,743	8,536	5,677	343,207,000	940,293	Venturi meters	82,418,415	16,000,000	Estimated
Belmont	115,000	6,320	6,220	169,220,000	728,600	Venturi & detector meters	109,196,200	2,487,500	Mostly metered
Brockton	2,186,340	65,200	75,100	1,093,188,210	.....	.....	766,060,190	Fire & fountains	.....
Brookline	2,011,311	31,000	31,000	988,624,658	4,271,029	Pump counters	785,136,853	96,136,853	Measured
Cambridge	6,644,219	112,000	112,000	3,985,123,900	19,245,600	Partly metered	.....	.....	f.
Chicopee	500,000	28,000	25,000	615,379,941	2,100,000	Pump counters	.....	.....	.....
Clinton	470,022	13,075	13,200	223,742,390	1,073,000	Venturi meter	137,902,300	500,000	Estimated
Concord	372,113	6,421	5,880	184,200,000	887,000	Venturi meters	45,619,477	4,000,000	Estimated
Danvers	.....	10,000	10,000	451,556,336	1,412,444	Pumps and reservoir	.....	.....	.....
Dudley	100,000	4,267	2,500	57,210,086	.....	Meters	.....	.....	.....
Easthampton	400,000	9,200	8,000	400,000,000	2,000,000	Reservoir gauge	100,000,000	.....	f.
Everett	750,000	37,700	37,700	.....	.....	Metered	All	.....	g.
Gardner	585,775	16,041	15,504	282,560,144	850,000	Venturi meter & counter	62,280,212	.....	.....
Haverhill	1,649,707	47,500	43,850	2,188,783,874	5,996,668	Estimated	385,996,500	.....	.....
Ipswich	216,214	5,777	5,000	.....	.....	.....	.....	.....	.....
Lexington	369,600	5,500	5,000	126,300,200	466,200	Venturi meter	.....	.....	.....
Lowell	.....	106,000	106,000	2,116,507,850	9,232,066	.....	1,143,462,915	.....	.....
Lynn	3,500,000	89,000	103,000	2,500,000,000	6,750,000	Pump counters	1,250,000,000	25,000,000	Estimated
Maynard	175,000	6,300	5,500	91,501,815	.....	Pump counters	.....	.....	.....
Midway	112,000	2,800	2,200	33,310,320	261,396	Pump counters	.....	None	.....
Natick	.....	9,866	9,866	206,323,407	562,269	Pump counters	94,365,732	None	.....
New Bedford	4,304,727	104,000	99,000	2,832,828,204	11,018,104	Pump counters & weir	2,224,415,767	None	.....
No. Attleboro	.....	10,450	10,000	162,393,691	950,000	Meters	92,464,000	None	.....
Northampton	866,558	19,542	18,000	.....	.....	.....	.....	.....	.....
Orange	195,000	5,600	4,327	48,411,503	132,634	Meters	26,308,627	Fountains	.....
Plymouth	456,000	12,200	11,000	477,000,000	2,400,000	Vent. met. & pump count.	91,700,000	.....	.....
Reading	348,450	6,500	5,950	89,013,344	.....	Pump counter	56,001,750	None	.....
Somerville	978,280	82,000	82,000	2,174,666,000	.....	Venturi meters	.....	.....	.....

For footnotes see page 655.

TABLE NO. 1—CONSUMPTION AND GENERAL. MUNICIPAL. (Continued.)

City.	Cost of plant.	Population. Total.	Population. Supplied with water.	Consumption. Total, gallons.	Consumption. Maximum daily, gallons.	Consumption. Method of obtaining figures.	Consumption. Passed through meters, gallons.	Consumption. Furnished free. Gallons.	Consumption. Furnished free. Method of obtaining figures.
So. Framingham	542,492	15,000	13,000	283,026,368	1,444,536	Pump counters	218,153,415	None	.....
Springfield	4,950,000	95,080	93,554	3,901,900,000	10,661,000	Venturi meters	2,104,006,680	.....	.....
Taunton	1,474,497	34,259	34,000	852,486,579	3,445,217	Pump counter	448,082,098	.....	.....
Uxbridge	130,000	5,000	4,200	.....	225,000	Partly metered	.....	.....	.....
Walpole	176,718	5,300	4,850	205,928,054	951,457	Pump counters	75%	10,000,000	Estimated
Waltham	837,894	31,000	30,800	991,809,390	3,566,692	Estimated	143,289,975	None	.....
Ware	157,726	9,000	8,850	166,219,200	.....	Pump counter	119,211,201	.....	.....
Westboro	.....	3,000	2,500	.....	.....	.....	.....	.....	.....
Winthrop	193,465	10,787	10,787h	251,730,000	689,700	Venturi meter	195,000,000	None	.....
Michigan:									
Alpena	275,256	12,706	12,386	828,597,505	.....	Pump counter	.....	215,625,000	Partly metered
Battle Creek	655,437	30,000	25,000	939,719,412	5,348,939	Venturi meters	664,331,000	178,000,000	Estimated
Boyne City	65,000	5,500	4,500	168,192,000	.....	Estimated	.....	800,000	Estimated
Crystal Falls	50,000	3,500	2,500	.....	.....	.....	.....	.....	.....
Flint	767,918	49,000	.....	1,504,849,140	3,504,443	Pump Counters	.....	.....	.....
Greenville	80,000	5,000	4,500	164,425,000	.....	Pump counters	None	b.	.....
Holland	214,233	11,100	10,000	352,039,484	2,731,050	6-in. meters	217,825,742	None	.....
Ishpeming	183,000	14,000	12,600	438,000,000	1,200,000	Metered	.....	.....	.....
Manistique	145,000	4,722	2,300	153,300,000	420,000	Estimated	4,942,000	225,000	Estimated
St. Clair	40,000	27,006	24,000	219,000,000	600,000	Pump counter	.....	.....	.....
Onaway	40,000	2,702	2,000	32,950,000	140,000,000	Estimated	.....	.....	.....
Saginaw	1,183,366	56,000	29,550	3,605,634,000	11,816,000	Pump counter	.....	.....	.....
Lansing	.....	42,000	30,000	1,095,000,000	.....	Part metered	25%	3,000,000	Estimated
Ypsilanti	.....	7,000	6,300	201,876,000	957,600	Pump counter	60%	.....	.....
Minnesota:									
Chisholm	45,000	8,000	5,000	135,000,000	550,000	Simplex meter	.....	.....	.....
Bemidji	74,000	5,000	4,000	9,000,000	.....	Meter	9,000,000	3,600,000	Estimated
Duluth	2,900,000	85,000	80,000	2,915,000,000	11,000,000	Venturi meter	.....	.....	.....
Cloquet	150,000	7,031	4,000	48,009,750	131,534	Meter	21,013,500	.....	.....
Fairmont	.....	3,500	3,500	300,000	.....	Pump counter	.....	.....	.....
Faribault	150,293	11,125	5,700	142,096,578	470,000	Pump counter	114,377,822	16,708,000	Largely measured
Lake City	130,000	3,750	400	67,000,000	220,000	Pump counter	33%	100,000	Estimated
Minneapolis	.....	335,306	300,000	9,513,509,900	26,064,408	Half measured	75%	.....	.....
Montevideo	60,000	4,000	2,000	35,000,000	150,000	Pump counter	.....	.....	.....
Northfield	55,000	3,500	.....	75,000,000	.....	Pump counter	.....	.....	.....
Owatonna	100,000	7,000	5,000	146,938,423	403,598	Estimated	150,000	100,000	Estimated
St. Paul	.....	246,760	210,000	4,896,644,901	19,896,384	Vent. met'r & pmp. countr	2,543,351,400	.....	.....
St. Peter	40,512	4,600	.....	33,783,083	110,000	Estimated	.....	.....	.....
Stillwater	155,000	11,200	6,000	.....	750,000	Pump Counter	.....	.....	Estimated
Thief River Falls	50,000	5,000	.....	35,000,000	100,000	Estimated	20,000,000	15,000,000	Estimated
Mississippi:									
Grenada	75,000	.....	3,500	.....	15,000	.....	.....	.....	.....
Canton	100,000	4,000	3,500	.....	.....	.....	.....	.....	.....
Meridian	750,000	30,000	22,000	803,000,000	2,600,000	Partly metered	396,000,000	18,250,000	Estimated
Clarksdale	.....	8,000	6,000	.....	.....	.....	.....	.....	.....
Water Valley	125,000	6,500	5,000	.....	250,000	.....	33%	50%	Estimated
Yazoo City	292,698i	6,796	6,296	.....	600,000	Pump counter	.....	3,000,000	Estimated
Jackson	548,000	28,000	26,000	1,277,500,000	3,750,000	Pump counter	428,597,760	6,000,000	Metered
Hattiesburg	110,000	12,000	.....	.....	750,000	Flow of wells	.....	.....	.....
Missouri:									
Farmington	30,000	3,000	1,800	20,000,000	70,000	Estimated	.....	.....	.....
Fulton	.....	5,500	4,500	58,400,000	200,000	Estimated	30,000,000	.....	.....
Higginsville	35,000	3,000	2,000	14,600,000	50,000	Estimated	.....	j.	.....
Kansas City	970,453,325	275,000	270,000	12,000,000,000	38,000,000	Vent. met'r & pmp. count'r	7,000,000	1,280,000	Estimated
Kirkwood	47,258	4,500	3,750	50,973,339	.....	Metered	50,973,339	2,500,000	Estimated
Montana:									
Miles City	175,000	7,000	6,500	266,260,000	1,300,000	Weir	.....	.....	.....
Nebraska:									
Alliance	79,000	5,000	3,500	.....	500,000	Metered	.....	13,140,000	Estimated
Blair	30,000	2,800	.....	.....	.....	.....	.....	.....	.....
Columbus	70,000	6,000	3,000	75,000,000	200,000	Estimated	60,000,000	15,000,000	Estimated
Fairbury	152,000k	5,200	3,000	.....	500,000	Pump counter	.....	.....	.....
Hastings	.....	11,000	.....	267,805,000	2,000,000	Pump counter	125,000,000	142,000,000	Estimated
McCook	75,000	4,000	4,000	120,000,000	1,000,000	Estimated	85,966,620	None	.....
Wahoo	48,000	2,168	.....	.....	125,000	.....	.....	.....	.....
North Platte	130,000	5,300	4,500	266,000,000	2,000,000	Pump counter j	.....	.....	.....
University Place	36,813	3,200	2,400	58,400,000	160,000	Estimated	56,000,000	2,400,000	Estimated
Schuyler	35,000	2,800	1,250	15,000,000	100,000	Estimated	10,000,000	5,000,000	Estimated

New Hampshire:									
Claremont	238,000	8,500	5,500	.....	.....	.....	60,000,000	None	.....
Concord	1,034,950	21,500	.....	900,000,000	3,000,000	Estimated	.....	Bldgs., except schools	.....
Dover	486,911	13,247	13,000	186,002,000	509,722	Venturi meter	56,749,457	.....	Metr'd excpt. st. sprink'g
Keene	385,493	11,000	10,000	.....	.....	.....	.....	.....	.....
Manchester	2,318,670	77,000	77,000	1,692,697,762	.....	Pump counter	75%	.....	.....
Newmarket	87,000	3,500	2,800	78,000,000	360,000	Pump counter	.....	.....	.....
Newport	118,952	4,000	3,300	100,000,000	300,000	Estimated	.....	50,000,000	Estimated
Portsmouth	500,000	11,000	11,000	630,008,512	.....	Estimated	.....	None	.....
New Jersey:									
Atlantic City	2,366,282	53,9001	.....	3,639,064,111	15,506,000	Vent. met'r & pmp. count'r	94%	e.	.....
Bridgeton	243,271	14,209	13,000	19,200,000	1,600,000	Estimated	None	.....	.....
Cape May	75,000	3,000	2,000m	426,923,200	.....	.....	10,766,354	.....	.....
Dover	260,000	8,000	8,000	172,122,980	477,049	Partly metered	75%	.....	.....
Madison	125,000	5,000	5,000	177,725,000	816,000	Pump counter	.....	None	.....
New Brunswick	852,281	30,000	30,000	1,294,039,802	3,545,313	Pump counter	63,100,000	.....	.....
New Mexico:									
Roswell	130,000	8,000	6,500	300,000,000	.....	Estimated	.....	5,000,000	Estimated
New York:									
Auburn	750,000	36,071	36,363	2,392,631,641	8,182,000	Pump counter checked by pitometer	529,620,188	.....	.....
Binghamton	1,100,000	55,000	50,000	2,644,924,700	.....	Pump counter	40%	b.	.....
Canajoharie	200,000	2,500	2,500	100,000,000	250,000	Estimated	25,000,000	25,000,000	Estimated
Carthage	250,000	4,000	3,000	182,500,000	500,000	Estimated	.....	.....	.....
Cortland	372,055	11,500	10,580	395,776,839	1,503,679	Pump counter	109,492,985	1,500,000	Estimated
Dolgeville	75,000	3,100	3,100	.....	.....	.....	.....	.....	.....
Catskill	.....	5,200	4,700	.....	.....	.....	.....	.....	.....
Corning	324,389	15,300	14,900	453,000,000	1,300,000	Venturi meter	444,890,034	8,109,966	Partly measured
Fairport	51,821	3,800	3,800	50,000,000	140,000	Partly metered	.....	.....	.....
East Syracuse	75,000	3,274	3,274	.....	.....	.....	.....	.....	.....
Fort Plain	109,500	2,800	2,500	120,000,000	450,000	Estimated	8,000,000	320,000	Estimated
Frankfort	70,000	4,000	3,500	.....	.....	.....	40%	.....	.....
Geneva	467,000	15,000	14,000	281,709,220	1,500,000	Metered	281,709,220	None	.....
Glens Falls	473,000	16,000	16,000	950,000,000	.....	Weirs	7,980,000	.....	.....
Homer	40,000	2,600	2,000	.....	175,000	.....	.....	.....	.....
Hoosick Falls	110,000	5,500	4,800	.....	950,000	Estimated	.....	.....	.....
Jamestown	1,068,812	40,000	40,000	1,162,116,800	4,000,000	Meters & pump counter	550,000,000	500,000,000	Partly measured
Lancaster	70,000	4,860	4,700	100,000,000	333,000	Trident crest meter	100,000,000	.....	.....
Leroy	70,000	3,800	2,800	.....	175,000	Pump counter	.....	.....	.....
Lestershire	.....	5,800	5,800	273,750,000	750,000	Estimated	207,166,975	.....	.....
Little Falls	.....	12,500	12,500	950,000,000	3,000,000	Weir	625,000,000	100,000,000	Estimated
Malone	253,000	7,000	7,000	401,500,000	1,100,000	Estimated	None	.....	.....
Mechanicsville	175,000	8,000	7,500	547,500,000	1,500,000	Metered	1,200,000	300,000	Estimated
Newark	95,043	7,000	6,000	140,284,000	800,000	Pump counter	.....	.....	.....
Newburgh	1,177,455	28,000	28,000	1,507,060,000	.....	Venturi meter	None	.....	.....
Oneida	180,000	9,500	7,000	146,000,000	450,000	Estimated	145,700,000	300,000	Estimated
Ossining	321,951	11,500	11,500	247,098,400	676,982	Pump counter	.....	.....	.....
Peekskill	750,000	16,832	16,000	1,232,230,370	.....	Pump counter	.....	.....	.....
Plattsburgh	382,191	12,000	14,000	700,000,000	2,000,000	Partly metered	5%	.....	.....
Poughkeepsie	916,149	32,000	30,000	584,676,750	3,000,000	Metered	584,676,750	13,500,000	Measured
Rochester	10,000,000	249,300	249,300	8,665,500,000	30,000,000	Weir	5,633,000,000	1,000,000	Estimated
Salamanca	114,000	8,700	6,000	400,000,000	1,200,000	Pump counter	.....	.....	.....
Solvay	110,000	6,000	6,000	151,000,000	600,000	Meter at station	110,000,000	10,000,000	Estimated
Tarrytown	550,283	5,600	5,900	247,979,000	800,000	Pump counter	150,000,000	.....	.....
Watkins	98,045n	3,500	.....	56,160,000	200,000	Metered	28,917,000	27,243,000	Estimated
Whitehall	.....	5,000	4,500	.....	650,000	Meters	All	8,000	Estimated
Waverly	238,000	5,000	6,700	244,368,000	670,241	Venturi meter	244,368,000	None	.....
Yonkers	3,267,071	90,000	89,000	3,168,169,079	8,679,915	Metered	All	.....	.....
North Carolina:									
Concord	200,000	11,000	3,000	60,000,000	250,000	Pump counter	.....	.....	.....
Gastonia	98,477	10,000	.....	104,359,500	345,000	Measured	.....	7,567,000	Partly measured
Lenoir	80,000	4,000	2,500	.....	100,000	Estimated	.....	.....	.....
Monroe	80,000	5,084	5,084	18,250,000	50,000	Estimated	14,000,000	4,250,000	Estimated
Mooresville	16,000	3,500	100	5,000,000	15,000	Estimated	3,000,000	None	.....
Morganton	40,000	3,000	2,000	33,000,000	110,000	Metered	.....	200,000	Estimated
Wilmington	650,000	30,000	.....	725,365,000	2,400,000	Pump counters	.....	.....	.....
Wilson	106,362	8,000	3,750	189,030,635	600,000	Metered	All but sprinkling	36,500,000	Partly estimated
North Dakota:									
Grand Forks	.....	14,000	14,000	346,000,000	2,500,000	Pump counter	90%	30,000,000	Estimated
Wahpeton	100,000	3,000	3,000	68,000,000	200,000	Pump counter	.....	.....	.....
Ohio:									
Alliance	375,000	17,000	15,000	1,600,000,000	5,000,000	Pump counter	50%	10–12%	Estimated
Ashland	100,000	8,000	7,000	155,475,675	425,961	Pump counter	.....	16,434,600	Estimated
Canton	1,200,000	60,984	49,000	2,288,610,312	.....	Pump Counter	656,339,000	.....	.....
Celina	.....	4,700	3,000	109,500,000	300,000	Estimated	.....	.....	.....
Cincinnati	.....	400,000	410,000	18,362,146,240	65,200,000	Pump counter	7,838,249,625	1,836,214,624	Estimated
Columbus	6,057,537	207,000	195,000	6,276,675,000	37,000,000	Venturi meter	3,759,623,000	42,000,000	Estimated

For footnotes see page 655.

TABLE NO. 1—CONSUMPTION AND GENERAL. MUNICIPAL. (Continued.)

City.	Cost of plant.	Population. Total.	Population. Supplied with water.	Consumption. Total, gallons.	Consumption. Maximum daily, gallons.	Consumption. Method of obtaining figures.	Consumption. Passed through meters, gallons.	Furnished free. Gallons.	Furnished free. Method of obtaining figures.
Ohio (Cont.)									
E. Cleveland	233,667	.....	2,763	389,482,500	884,800	Metered	.....	5,625,000	Partly measured
Findlay	600,000	16,000	13,000	495,546,628	1,357,662	Pump counter	330,364,414	165,182,214	Estimated
Hamilton	1,300,000	37,480	28,000	1,131,500,000	3,100,000	Pump counter	.....	.....	.....
Leetonia	.....	2,700	590	30,000,000	.....	.....	.....	.....	.....
Marietta	210,000	15,000	12,000	92,000,000	250,000	Pump counter	.....	18,000,000	Estimated
Medina	60,000	3,500	2,000	50,000,000	125,000	Estimated	.....	8,875,000	Estimated
Millersburg	75,000	2,000	1,800	1,500,000	500,000	Estimated	.....	.....	.....
Orville	60,000	3,500	3,000	262,410,600	750,000	Meter	2,100,400	50,000,000	Estimated
Reading	69,500k	4,300	2,200	34,792,800	200,000	Metered	28,676,000	3,000,000	Estimated
Salineville	48,000	2,800	2,000	54,750,000	150,000	Measured at reservoir	.....	.....	.....
Springfield	1,160,000	60,000	56,000	2,528,197,609	9,000,000	Pump counter	616,954,503	.....	.....
Toronto	75,000	5,000	5,000	7,200,000	600,000	Estimated	250,000	e.	.....
Troy	200,990	6,200	6,000	311,982,000	1,300,000	Pump counter	.....	48,200,000	Estimated
Wapakoneta	.....	5,500	.....	109,500,000	500,000	Estimated	.....	2,500,000	Estimated
Wauseon	.....	3,000	2,500	110,000,000	300,000	Meters	80,000,000	30,000,000	Estimated
Wyoming	77,500	2,100	6,100	136,220,744	925,000	Metered	All	23,250,837	Metered
Oklahoma:									
Davis	30,000	1,500	1,000	14,600,000	70,000	Estimated	5,000,000	2,000,000	Estimated
Durant	.....	7,000	7,000	300,000,000	1,000,000	Measured at filter	.....	.....	.....
Edmond	69,000	.....	.....	33,500,000	135,000	Partly metered	29,000,000	2,000,000	Estimated
Okmulgee	173,000	10,230	8,850	240,000,000	850,000	Measured at basin	90%	.....	.....
Guthrie	170,000	12,500	7,000	176,000,000	650,000	Partly metered	77,988,000	.....	.....
Hartshorne	125,000	3,000	250	27,600,000 o	.....	.....	.....	.....	.....
McAlester	415,023	15,000	15,000	292,000,000	800,000	Estimated	.....	e.	.....
Tulsa	600,000	40,000	20,000	1,356,750,000	3,750,000	Pump counter	.....	.....	.....
Oklahoma City	1,315,500	70,000	.....	.....	12,000,000	.....	.....	.....	.....
Oregon:									
Eugene	145,423	11,000	8,000	365,000,000	1,700,000	Differential gauge	.....	43,000,000	Partly measured
Medford	500,000	10,000	10,000	.....	3,000,000	Weir and meters	80,000	250,000	Estimated
Portland	10,854,224	282,000	250.700	.....	.....	Partly measured	2,527,400,000	.....	.....
Pennsylvania:									
Altoona	.....	55,500	55,500	754,631,000	7,000,000	Meters	.....	20,000,000	Estimated
Bradford	567,981	17,000	16,500	730,000,000	2,000,000	Estimated	.....	.....	.....
Brookville	122,102	5,000	2,500	115,647,000	555,000	Pump counter	12,713,000	None	.....
Chambersburg	343,250	13,000	12,800	750,000,000	2,500,000	Weir	350,000,000	15,000,000	Estimated
Coatesville	150,000	1,400	1,400	4,660,000	.....	Pump counter	.....	.....	.....
Doylestown	80,000	4,000	3,600	109,500,000	300,000	.....	.....	.....	.....
Duquesne	146,000	16,000	15,200	277,000,000	800,000	Mostly metered	144,000,000	8,000,000	Estimated
Ford City	.....	5,000	5,000	13,914,800	65,520	Estimated	All	.....	.....
Harrisburg	.....	70,000	70,000	3,089,853,531	8,390,373	.....	.....	273,500,000	Partly measured
Hollidaysburg	.....	4,000	4,500	.....	.....	.....	.....	e	.....
Juniata	100,000	7,000	7,000	180,000,000	500,000	Estimated	.....	.....	.....
Lancaster	2,000,000	54,000	60,000	2,645,240	7,300,000	Venturi meter	858,263,000	58,000,000	Estimated
McKeesport	1,032,565	42,700	32,000	1,304,115,905	4,447,000	Pump counter	448,255,102	300,000,000	Estimated
Meadville	358,484	14,000	14,000	729,349,428	2,000,000	Pump counter	.....	.....	.....
Media	153,000	3,562	5,312	204,677,658	733,436	Pump counter	20,741,275	e.f	.....
Millvale	.....	8,000	8,000	.....	1,200,000	Estimated	None	.....	.....
North East	80,000	3,000	2,600	.....	450,000	Estimated	.....	.....	.....
Reading	4,098,184	101,030	100,930	5,227,195,654	19,170,050	Vent. & pmp. counter	1,708,935,955	.....	.....
Sharpesville	44,000	3,500	.....	.....	200,000	Pump counter	.....	e	.....
Shippensburg	75,000	4,500	6,000	144,000,000	400,000	Estimated	.....	200,000	Estimated
Steelton	275,000	15,000	14,000	500,000,000	1,300,000	Weirs	All	.....	Metered
Tamaqua	.....	10,000	10,000	528,000,000	1,440,000	Estimated	.....	.....	.....
Rhode Island:									
East Providence	275,000	17,000	9,100	160,000,000	.....	Meter	80%	None	.....
Providence	7,725,653	241,000	266,000	6,464,458,183	25,337,350	Vent. mt'r & reservoir	4,525,120,728	None	.....
Westerly	428,736	13,500	11,000	310,690,000	851,200	Pump counter	.....	None	.....
Woonsocket	1,139,711	42,150	47,500	558,129,000	2,300,000	Venturi meter	480,503,000	None	.....
South Carolina:									
Aiken	153,760	3,911	5,000	109,520,000	450,000	Pump counter	33,993,000	b	.....
Cheraw	78,000	3,000	500	6,000,000	16,000	Measured	.....	None	.....
Clinton	80,000	4,500	3,400	.....	50,000	Meters	.....	100,000	Estimated
Florence	90,000	10,000	5,000	143,118,300	420,000	Pump counter	63,438,000	17,485,000	Partly metered
Georgetown	90,000n	6,000	.....	105,000,000	.....	.....	.....	.....	.....
Rock Hill	175,000	10,500	7,500	312,000,000	225,000	Pump counter	All	None	.....
Sumter	165,000	11,000	5,700	140,000,000	600,000	Pump counter	102,000,000	32,400,000	Estimated
Union	.....	6,000	3,000	100,000,000	450,000	Pump counter	70,000,000	30,000,000	.....

South Dakota:									
Aberdeen	.....	13,000	10,000	365,000,000	.....	Estimated	None	200,000	Estimated
Deadwood	.....	3,653	3,653	.....	.....	.....	.....	.....	.....
Huron	133,000	6,000	5,000	120,000,000	661,200	Pump counter	60,000,000	40,000,000	Estimated
Mitchell	67,262	8,000	4,000	140,000,000	500,000	Estimated	.....	500,000	Estimated
Rapid City	140,000	4,000	4,000	126,200,000	.....	Estimated	54,262,300	50,000,000	Estimated
Tennessee:									
Clarksville	150,000	8,500	5,000	292,000,000	1,000,000	Estimated	10%	.....	.....
Humboldt	50,000	5,000	2,700	144,000,000	500,000	Estimated	50,000,000	20,000,000	Estimated
Paris	50,000	5,000	5,000	.....	400,000	Pump counter	.....	None	.....
Tullohoma	51,500	4,500	3,600	.....	90,000	.....	None	.....	.....
Texas:									
Albany p	17,000	2,000	.....	.....	.....	.....	.....	.....	.....
Brownwood	100,000	10,000	7,500	255,500,000	800,000	Weir	102,200,000	.....	.....
Cleburne	210,000	15,000	15,000	95,000,000	1,000,000	Pump counter	.....	.....	.....
Ballinger	53,122	3,600	9,570	52,560,000	.....	Estimated	35,000,000	10,500,000	Estimated
Bay City	45,000	5,000	3,500	54,000,000	150,000	Meter	All	1,000,000	Estimated
Denton	129,000	7,500	6,000	100,000,000	500,000	Estimated	65%	2,000,000	Estimated
Georgetown	71,000	3,500	3,500	163,800,000	700,000	Estimated	None	2,000,000	Estimated
Houston	1,581,628	120,000	.....	1,972,165,870	5,400,000	Meters	1,606,110,100	366,055,860	Estimated
Long View	50,000	8,000	4,000	75,000,000	300,000	Partly metered	125,000	j.	.....
Lufkin	600,000	6,000	2,000	54,000,000	165,000	Meter	.....	5,000,000	Estimated
Nacagdoches	65,000	7,500	5,500	18,250,000	50,000	Meters	90%	3,650,000	Estimated
Paris	350,000	13,500	8,000	250,000,000	700,000	Meter	.....	.....	.....
Waxahachie	118,696	10,000	8,800	109,500,000	300,000	Meter	All	.....	.....
Waco	1,259,753	40,000	.....	1,973,538,000	6,500,000	Pump counter	20%	20%	Estimated
Utah:									
Ephriam	40,000	2,400	2,400	.....	.....	.....	.....	.....	.....
Nephi	.....	2,750	2,500	.....	.....	.....	115,000	.....	.....
Salt Lake City	6,300,000	110,000	100,000	6,795,030,000	25,560,000	Weirs with aut. regis.	.....	139,381,190	Estimated
Vermont:									
Barre	333,000	.....	.....	547,500,000	1,500,000	Estimated	.....	None	.....
Burlington	.....	21,300	21,100	384,911,942	1,054,553	Metered	73.35%	None	.....
Virginia:									
Buena Vista	25,000	4,000	3,000	40,000,000	200,000	Partly measured	8,000,000	fire only	.....
Charlottesville	355,000	9,000	.....	396,000,000	1,200,000	Partly measured	40%	10%	Estimated
Clifton Forge	190,000	6,000	5,900	730,000,000	2,500,000	Estimated	14,000,000	None	.....
Marion	35,000	3,200	3,160	55,000,000	150,000	Estimated	None	365,000	Estimated
Petersburg	475,000	25,000	20,000	550,000,000	2,000,000	Pump counter	550,000,000	.....	.....
Washington:									
Bellingham	.....	35,000	35,000	.....	.....	.....	10%	.....	.....
Port Townsend	281,454	4,100	3,000	127,750,000	350,000	Estimated	.....	.....	.....
Pullman	.....	3,500	3,000	20,000,000	55,000	Meter	19,999,810	98,060	Estimated
Seattle	12,000,000	300,000	275,000	9,000,000,000	35,000,000	85% metered	7,200,000	None	.....
Spokane	4,646,659	104,402	104,402	13,634,207,980	56,118,240	Pump counter	.....	180,000,000	Estimated
Walla Walla	.....	20,000	20,000	.....	8,000,000	Estimated	.....	g.	.....
West Virginia:									
Fairmont	300,000	17,000	14,000	1,095,000,000	3,750,000	Pump counter	60,000,000	20,000,000	Estimated
Keyser	75,000	5,000	5,000	.....	.....	.....	.....	.....	.....
Martinsburg	.....	12,000	12,000	521,000,000	1,677,500	Pump counter	56,717,780	.....	.....
Sistersville	60,000	5,000	5,000	244,550,000	1,500,000	Estimated	36,500,000	2,000,000	Estimated
Wisconsin:									
Baraboo	132,000	6,700	5,000	150,000,000	500,000	Pump counter	90,000,000	.....	.....
Berlin	70,000	4,636	.....	67,000,000	.....	Partly metered	16,376,000	.....	.....
Eau Claire	.....	20,000	15,000	750,000,000	3,500,000	Estimated	.....	None	.....
Ft. Atkinson	68,033	4,000	.....	63,404,346	476,630	Pump counter	49,610,760	.....	.....
Grand Rapids	145,083	7,000	4,700	114,873,297	.....	Pump counter	41,721,172	.....	.....
La Crosse	846,165	32,000	26,000	1,015,538,000	5,749,400	Pump counter	236,460,500	300,000,000	Estimated
Lake Geneva	91,957	3,500	.....	50,000,000	600,000	Estimated	36,498,054	.....	.....
Marshfield	155,000	6,500	.....	300,000,000	900,000	Pump counter	299,000,000	1,000,000	Estimated
Milwaukee	7,485,351	410,000	430,000	17,493,257,940	65,206,040	.....	12,706,942,100	None	.....
Pt. Washington	135,000	3,700	2,460	81,000,000	.....	Estimated	.....	.....	.....
Sparta	102,441	4,000	.....	120,031,765	525,920	Pump counter	97,600,000	None	.....
Canada: q									
Brantford, Ont	619,179	26,400	24,000	1,381,378,655	3,784,599	Pump counter	456,431,000	None	.....
Calgary, Alta	3,133,398	80,000	75,000	4,380,000,000	12,000,000	Estimated	503,770,740	.....	.....
London, Ont	1,240,000	52,370	50,000	1,567,750,000	.....	Metered	399,437,000	None	.....
Quebec, Que	4,000,000	80,000	80,000	3,285,000,000	12,000,000	Estimated	50,000,000	.....	.....
St. Catherines, Ont	819,813	17,000	17,000	1,240,000,000	3,000,000	Estimated	115,000,000	None	.....
Toronto, Ont	11,200,000	445,575	.....	17,530,415,000	58,000,000	Venturi meters	3,941,390,927	None	.....
Winnipeg, Man	5,690,769	210,000	.....	2,916,941,812	8,981,900	Meters	.....	None	.....

a—Water also used for irrigating. b—Streets, fountains and public buildings. c—In winter, 12,000; 10,000 supplied with water. d—In winter, 16,000. e—Public buildings. f—Water for city to be metered this year. g—Street sprinkling and fountains. h—About 5,000 additional during the six summer months. i—Includes light and sewer departments. j—Public fountains. k—Includes lighting plant. l—250,000 summer population additional. m—About 15,000 in summer. n—Includes sewer system. o—Twenty-four million of this sold to another town. p—Plant just being constructed. q—All quantities are believed to be in imperial gallons.

WATER WORKS STATISTICS

Figures Furnished to Us for This Purpose by the Superintendents of Five Hundred Water Works Plants, Both Municipal and Private—Consumption—Meters—Distribution System—Purification Methods.

Statistics from nearly 500 water works plants in the United States and Canada will be found tabulated in this issue. A number of replies have been received too late to be included in the tables, which will bring the total up to about 550, and probably enough will be received within the next week or two to raise the number to 600. The figures for these late reports will be published in supplementary tables, probably in about a month.

The cities represented in the tables are located in all sections of the country, the plants are of all sizes, from the largest to the smallest, and all variations as to construction and operation, source of supply, purification, etc., will be found in the list. Of the 550 replies in hand, 100 are from private plants and 450 from municipal plants. While it is not probable that these figures correctly represent the actual ratio between private and municipal plants the country over, it is indicative of the undoubted fact that the number of municipal plants greatly exceeds that of private.

The omission from the tables of the largest cities seems to be avoidable for several reasons—that most of the large cities have not yet prepared their reports for the year 1913; that their methods of accounting do not correspond with the questions asked, and the figures as kept by them are so voluminous and complicated as to make it difficult to obtain figures corresponding to the column headings of our tables.

As to these last, we have based the questions asked and column headings upon the form recommended by the American and New England Water Works Associations, this being the only one which has met with anything like general use; and the difficulty many superintendents have found in supplying the figures requested is an indication of the desirability of the more general adoption of this or some other standard form. A considerable number of those replying, however, use this form, and their answers are to be interpreted in accordance with the standard methods prescribed.

The population is generally estimated more or less approximately. In a few cases that of the 1910 census is given.

The method of obtaining the figures of consumption (water passing through the mains) was in most cases that of using the plunger displacement and the number of strokes, with an allowance for slip in a considerable number of cases. These are all recorded in the table as "pump counter." Where the supply is not pumped, this is of course impossible, and a number of these (and some of the pumping systems) use a venturi meter for this purpose. Filter capacity, flow of well, etc., also are used in estimating, while a few of the figures are apparently guesses pure and simple.

The use of meters to a greater or less extent is seen to have become almost universal, only two or three percent of the cities reporting not having a few, at least, while a considerable number meter from 50 to 80 percent of their services, and a few meter all of them.

Comparison with tables of previous years indicate that the practice is becoming more general of providing special appliances for filling watering carts, and thus preventing to a considerable extent the abuse to which hydrants are apt to be subjected by drivers of such carts. About half of the cities report the use of "standpipes," "cranes," etc., for this purpose.

A few New England cities still lay cement lined pipe for water mains, but a very few, a greater number reporting that they are yearly replacing old pipe of this kind with cast-iron.

A number of cities are seen to furnish water for private fire protection through 6-inch and even 8-inch pipes. Some waterworks men condemn the use of such large pipe for this purpose because of the enormous loss of water should such a pipe be broken inside a factory during a fire.

The use of meters on private fire connections is by no means standardized. A number use ordinary disc or rotary meters of 2 inches or less; apparently about half use no meters at all on such lines; but a considerable number use meters especially designed for this purpose, and several who do not express their opinion that it should be done.

In the answer to the question as to maintenance of meters, we recorded the consumer as maintaining them if he paid the city for such service. The cost of "maintenance, etc.," is intended to include repairs and reading, but in a few cases which are known (and, we suspect, many which are not) the cost of reading is not included. In some small plants the superintendent does all this work and the cost is difficult to ascertain. The last two tables show that treatment of water in some form is becoming increasingly common, if only by hypochlorite.

TABLE NO. 2.—CONSUMPTION AND GENERAL— PRIVATE.

City.	Cost of plant.	Population. Total.	Population. Supplied with water.	Consumption. Total gallons.	Consumption. Maximum daily, gallons.	Consumption. Method of obtaining figures.	Consumption. Passed through meters, gallons.	Consumption. Furnished free, gallons.	Consumption. Method of obtaining free figures.
California:									
San Jose	1,500,000	50,000	43,000	1,825,000,000	10,000,000	Weirs & pumps	700,000,000	No data	.....
Stockton	800,000	35,000	30,000	1,510,417,976	7,000,000	Pump counter	300,000,000	None	.....
Visalia	150,000	6,000	6,000	400,000,000	.....	.....	10 per cent	.....	.....
Watsonville	.....	6,200	7,000	.....	1,400,000	Estimated	.....	None	.....
Connecticut:									
Litchfield	85,000	1,000	1,000	No record	No record	.....	.....	Sewers & Sts.	.....
Naugatuck	.....	14,000	12,000	.....	1,750,000	Estimated	.....	.....	.....
New Canaan	.....	2,000	2,000	96,000,000	400,000	Venturi meters	.....	.....	.....
Plainville	.....	2,882a	2,250	82,125,000	350,000	Pump & standpipe gauge	.....	No data	.....
Portland	188,000	4,000	3,500	.....	175,500	Estimated	3,650,000	365,000	Estimated
Illinois:									
Carlinville	75,000	4,000	2,500	.....	400,000	Pump counter	None	For fires only	.....
Effingham	105,000	5,000	1,200	275,000,000	800,000	Metered	275,000,000	240,000	Estimated
Harvey	.....	7,227	5,560	102,078,893	600,000	Meter	All	.....	.....
La Grange	.....	10,500	6,870	150,880,852	750,000	Meter	All	.....	.....
Lincoln	Not known	11,000	7,900	237,000,000	1,200,000	Pump counters	.....	.....	.....
Peoria	.....	75,000	44,500	3,668,898,256	18,444,130	Pump counter & Simplex meter	.....	182,500,000	Part meter, part etimate
Pontiac	.....	6,090	3,500	209,672,500	1,050,500	Pump counter	All	.....	.....
Quincy	825,000	36,587	30,000	702,000,000	3,021,755	Venturi meter	483,000,000	.....	.....
Streator	624,000	16,000	14,000	710,892,000	2,385,000	Pump counter	263,337,000	26,874,000	Metered, except counter & sewer flush'g

For footnotes see page 657.

TABLE NO. 2.—CONSUMPTION AND GENERAL— PRIVATE—(Continued).

City.	Cost of plant.	Population. Total.	Population. Supplied with water.	Consumption. Total gallons.	Consumption. Maximum daily, gallons.	Consumption. Method of obtaining figures.	Consumption. Passed through meters, gallons.	Consumption. Furnished free, gallons.	Consumption. Method of obtaining free figures.
Indiana:									
Greensburg	.....	7,500	6,000	185,000,000	700,000	Pump counter	.....	Not known	Ptly metered
Indianapolis	.....	270,000	180,000	6,500,000,000	30,000,000	Venturi meter	2,000,000,000	730,000,000	.....
Jeffersonville	.....	15,000	9,000	325,000,000	1,500,000	Pump counters	75,000,000	b	.....
Linton	130,000	8,000	5,000	182,500,000	.....	Estimated	69,002,000	Sewer flushing	.....
Richmond	.....	25,000	23,000	954,000,000	3,500,000	Pump c'nters c	475,000,000	90,000,000	Mostly measured
Seymour	218,000	8,000	6,000	200,000,000	1,000,000	Estimated	About ½	.....	.....
Valparaiso	165,427	8,500	7,650	316,649,209	1,160,100	Pump counter	.....	b.d.	.....
Vincennes	.....	15,500	2,000	.....	2,000,000	Pump counter	.....	.....	.....
Kansas:									
Cherokee	40,000	1,400	1,050	22,000,000	75,000	Meter	.....	.....	.....
Kentucky:									
Ashland	.....	10,000	10,000	500,000,000	1,500,000	Pitometer	400,000,000	Not measured	.....
Bellevue & Dayton	.....	13,663	.....	152,020,147	.....	10" Premier meter	80,632,986	None	.....
Hopkinsville	186,000	12,800	6,600	152,453,800	650,000	Pump counter	109,452,730	No record	.....
Maysville	No record	8,000	7,000	300,000,000	8,000,000	Estimated	11%	Fire protection	.....
Middlesborough	750,000e	8,000	6,000	20,000,000	600,000	Estimated	10,000,000	None	.....
Pineville	61,000	3,800	3,100	160,000,000	500,000	Pump counter	None	None	.....
Maine:									
Ellsworth	.....	Abt. 4,000	.....	.....	.....	.....	.....	.....	.....
Maryland:									
Hagerstown	850,790	22,000	18,000	839,500,000	2,500,000	Venturi meter	529,250,000	2,000,000	Estimated
Massachusetts:									
Bridgewater	.....	7,000	5,000	115,705,436	.....	Pump counter	.....	.....	.....
Hudson	300,000	7,000	6,500	108,182,089	296,389	Venturi meter	200,000	96,389	Estimated
Whitinsville	.....	6,000	5,500	182,500,000	500,000	Estimated	Very little	None	.....
Michigan:									
Alma	.....	3,500	2,500	.....	275,000	8" Gem meter	.....	10,151,000	Measured
Iron Mountain	250,000	10,000	7,500	192,000,000	.....	Pump counters	82,000,000	3,650,000	Estimated
Minnesota:									
Hutchinson	35,000	3,000	.....	.....	.....	.....	.....	.....	.....
Mississippi									
Bay St. Louis	30,000	3,000	1,200	Not known	Not known	.....	None	Not known	.....
Missouri:									
Carrollton	150,000	3,800	2,000	73,000,000	250,000	Estimated	1 per cent.	.....	.....
Chillicothe	110,000	9,000	.....	192,000,000	650,000	Pump counters	100,000,000	50,000,000	Estimated
Montana:									
Livingston	.....	6,000	6,000	518,700,000	3,000,000	Estimated	.....	25,732,000	.....
New Hampshire:									
Berlin	.....	14,000	13,000	452,600,000	No record	Estimated	66,705,188	.....	.....
Walpole	51,000	2,600	.....	No record	No record	.....	.....	.....	.....
New Jersey:									
Somerville	310,549	8,732	4,900	596,274,509	1,933,109	Pump counters	.....	.....	.....
New York:									
Amityville	.....	3,000	460	55,000,000	350,000	Estimated	None	1 horse trough	.....
Elmira	2,000,000	52,000	52,000	2,161,715,500	7,440,000	Venturi meter	300,000,000	Unknown	.....
Ilion	247,000	8,500	8,450	307,986,000	900,000	Venturi meter	.....	g.	.....
Mt. Vernon	3,000,000	35,000	35,000	766,500,000	3,000,000	Venturi meter	360,255,000	11,000,000	Estimated
New Rochelle	2,662,350	.....	.....	.....	.....	Pump counter and meters	.....	.....	.....
Seneca Falls	400,000	8,000	5,000	370,000,000	.....	Estimated	.....	No data	.....
North Carolina:									
Henderson	125,000	.....	6,500	180,000,000	500,000	Estimated at filter	.....	.....	.....
Ohio:									
Conneaut	.....	10,000	8,000	521,000,000	1,700,000	Pump counters	347,250,000	21,000,000	Estimated
Delaware	240,000	11,000	9,500	386,539,000	1,450,000	Pump counters	.....	.....	.....
Washington, C. H.	.....	8,000	6,000	225,000,000	850,000	Estimated	.....	Not known	.....
Pennsylvania:									
Carbondale	2,500,000	25,000	40,000	2,100,000,000	6,000,000	Venturi meter	6,000,000	None	.....
Ellwood City	480,000	4,500	7,000	816,783,000	2,238,000	Meter & est.	615,302,000	Not known	.....
Galeton	.....	5,000	5,000	273,750,000	750,000	Estimated	3,000,000	15,000,000	Estimated
Gettysburg	105,000	4,000	4,000	140,000,000	4,000,000	Pump counter	.....	None	.....
Hanover	550,000	.....	12,000	450,000,000	1,250,000	Part estimate	180,000,000	.....	.....
Hazleton	.....	20,000	.....	350,000,000	1,000,000	By meter	.....	None	.....
Indiana	265,000	7,000	5,000	175,000,000	500,000	Estimated	120,000,000	Not known	.....
Jersey Shore	.....	7,500	7,500	732,000,000	2,225,000	Part estimate	.....	.....	.....
Lehighton	.....	6,000	5,000	730,000,000	.....	Estimated	146,000,000	50,000	Estimated
Lewistown f	.....	18,000	17,000	Not known	3,000,000	Estimated	1,500,000	Not known	.....
McDonald	131,600	5,000	5,000	183,129,396	566,000	Pump counter	138,000,000	..... Schools	metered
Minersville	Not known	8,000	10,000	1,000,000	.....	Estimated	.....	Fire service	.....
Myersdale	125,000	3,750	3,500	.....	245,000	Estimated	.....	None	.....
Parkesburg	75,000	2,500	2,000	.....	125,000	Pump counter	.....	.....	.....
Pittsburgh	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sayre	.....	10,000	8,000	547,500,000	1,500,000	Pump counter	.....	.....	.....
Shamokin	1,500,000	35,693a	35,000	1,600,000,000	5,000,000	Estimated	.....	Not known	.....
Towanda	385,000	4,800	5,000	.....	.....	.....	.....	.....	.....
West Newton	65,000	3,000	2,000	50,000,000	160,000	Estimated	22,000,000	Not known	.....
Winkinsburg	.....	85,000	85,000	3,193,698,529	.....	Venturi meter & pump c'ntr	Practically all	11,441,632,000	By meter
So. Carolina:									
Charleston	.....	65,000	35,000	.....	7,000,000	.....	.....	.....	.....
Texas:									
Navasota	75,000	6,500	5,000	.....	300,000	Estimated	.....	25,000	Estimated
San Angelo	250,000	13,000	10,000	240,000,000	1,000,000	Pump counter	50 per ct.	50,000,000	Estimated
Stamford	.....	5,000	4,500	.....	200,000	Estimated	.....		
Wisconsin:									
Ashland	704,548	12,000	11,000	465,673,100	1,720,570	Pump counter	162,941,250	23,000,000	Measured
Green Bay	840,462	27,000	.....	439,582,195	1,696,900	Pump counter	.....	None	.....
Rhinelander	141,679	4,000	3,800	104,791,000	400,140	Pump counter	12,584,000	9,600,000	Estimated
Superior	1,597,844	43,000	38,000	684,042,000	2,482,000	Venturi meter	327,796,700	120,000,000	Estimated
Washburn	.....	3,800	.....	.....	.....	.....	.....	.....	.....

a—Population in 1910.
b—All city buildings, schools and public drinking fountains.
c—Is installing a Venturi meter.
d—Sewer flushing.
e—Includes reservoir and large area of watershed.
f—Includes also Burnham, Yeagertown, Reedsville and Milroy.
g—City departments, streets, sewers and fire.

TABLE NO. 3.—DISTRIBUTION SYSTEMS—MUNICIPAL.

City.	Street Mains: Laid during year, feet.	Materials.	Discontinued during year, feet.	Now in service, miles.	Hydrants in service.	Stop gates in service.	Sprinkling cart appliances.	Service Connections: Added during year.	Now in use.	Motor and Elevator Connections: Added during year.	Discontinued during year.	Private Fire Connections: Number in use.	Sizes.
Alabama													
Mobile	21,495	C. I. & W. I.	....	....	974	....	.....	285	12,610	0	0	70	4 & 6
Talladega	0	.....	0	....	97	34	4 special valves.	42	600	..	..	..	....
Arizona:													
Globe	3,500	.....	....	35	48	200	.....	35	1,600	0	0	15	....
Arkansas:													
Fayetteville	3,000	C. I.	0	12	67	1,100	3 cranes.	50	1,100	0	0	5	2
California:													
Lodi	10,000	C. I. & W. I.	0	20	82	20	6 cranes.	150	700	0	0	4	2
Los Angeles	379,408	C. I.	0	586.22b	3,839	5,939	0	2,479	81,646	..	..	155	1½ to 8
Oxnard	40,000	C. I.	....	8	93	44	.....	....	700	..	..	4	2 & 2½
Redlands	198,556	.....	5,000	82	268	427	.....	117	3,434	0	0	4	4
San Diego	201,998	C. I.	76,926	325.93	835	2,496	172 standpipes.	1,676	14,153	..	..	71	2 to 6
Tulare	63,360	C. I. Converse	63,360	68,640	174	250	0	50	800	0	0	6	2
Whittier	6,000	W. I.	63,360	....	..	...	.....	125	2,000	..	..	0	....
Colorado:													
Colorado Springs	931	C. I.	0	143	505	1,894	12	86	11,946	0	0	2	4 & 6
Fort Morgan	0	.....	0	13	72	26	Penstock.	10	751	0	0	0	....
Golden	2,100	C. I.	....	....	..	...	.....	..	....	..	..	6	2
Grand Junction	1,300	W. I.	0	30	225	300	0	100	3,000	4	1	20	2
Greeley	6,350	Steel	0	36	111	124	1	36	2,021	0	0	12	2 & 4
Montrose	3,275	C. I.	....	22	43	64	Standpipes.	20	1,000	..	..	10	1¼ & 1½
Silverton	1,340	W. I.	0	9½	32	....	0	0	560	0	..	12	2
Connecticut:													
Bristol	4,000	C. I. & W. I.	800	41	131	286	Flush hydrants and standpipe.	76	1,908	0	..	30	7 to 11
New Britain	12,630	C. I.	0	86	636	1,201	95 sprinkler posts.	92	4,815	0	0	75	2½
New London	4,617	C. I.	0	68.4	399	605	47 water cart hydrants	71	4,310	0	0	27	2-8
Putnam	5,000	C. I.	18	18	95	161	0	25	1,000	0	0	13	2 to 8
Southington	41,722	C. I. & W. I.	5,479	28.295	137	275	Standpipes.	48	1,024	0	1	22	2 to 8
South Norwalk	2,670	Iron	....	46	258	....	5 crane hydrants.	88	2,595	..	..	12	6
Waterbury	8,109	C. I.	1,667	88	630	821	Standpipes and trolley car fillers.	195	7,014	..	..	..	....
Willimantic	1,548	C. I.	0	....	216	151	0	50	1,473	1	0	57	6
Winsted	423	C. I.	....	23½	245	310	Standpipes.	11	1,205	..	..	24	4 & 6
Delaware:													
Dover	1,600	C. I.	0	8½	50	44	2	18	692	0	0	5	2 to 4
District of Columbia	138,506	C. I.	11,183	575	3,166	8,618	Standpipes.	2,014	65,732	..	..	36	2 to 8
Florida:													
Bartow	5,700	C. I.	0	6	58	30	0	60	650	0	0	2	2½
Daytona	8,300	C. I. & W. I.	0	11.582	67	75	0	131	478	0	0	19	¾ to 4
Jacksonville	25,962	C. I. & Gal.	1,045	59.36	721	604	0	841	10,111	0	0	71	3 to 8
Key West	1,000	C. I.	0	8¼	100	68	0	8	79	..	..	5	1½ to 4
Marianna	....	.....	....	4	35	6	.....	30	372	..	..	..	....
Ocala	800	C. I.	....	8	108	....	0	..	750	0	..	0	....
St. Petersburg	15,000	C. I.	0	32	135	225	0	235	1,135	0	..	4	2½ to 4
Georgia:													
Americus	0	....	0	18	137	540	2 2-in. curb openings.	83	1,143	0	0	12	4 & 6
Augusta	17,870	C. I.	....	104	1,148	....	.....	350	5,741	5	..	..	2½
Bainbridge	800	C. I.	0	8	77	12	0	50	920	10	4	0	....
Griffin	12,000	C. I.	....	17	131	108	1 2-in. service pipe.	71	617	..	..	7	1 to 6
Madison	....	.....	0	5	40	18	0	23	190	0	0	0	0
Statesboro	1,000	.....	....	....	200	15	.....	..	...	..	..	..	....
Thomasville	3,000	C. I.	0	....	103	29	0	53	741	0	0	3	2 & 3
Illinois:													
Blue Island	3,000	C. I.	0	20	300	200	0	100	1,800	0	0	0	....
Bridgeport	47,520	.....	....	9	55	33	.....	223	190	..	..	1	2
Canton	224	C. I.	0	27.5	189	220	0	50	1,700	0	0	..	....
Chicago	45,048,960	C. I.	9.80	2,404.54	25,687	21,450	.....	12,626	....	..	..	..	¾ to 12
Decatur	18,000	C. I.	0	70	614	800	0	325	5,300	..	..	18	4 & 6
Highland Park	1,500	Iron	....	32	145	105	0	38	1,100	0	0	10	1½ to 2½
Hinsdale	1,000	.....	0	25	200	50	0	40	750	0	..	0	....
Naperville	0	.....	0	12	140	....	0	38,614	...	..	..	..	....

Rockford	26,121	C. I.	490	112.6	670	1,382	.....	532	9,305	..	1	78	2 to 8
Rock Island	20,000	C. I.	0	49	460	800	0	275	6,520	0	0	8	4
Salem	2,800	C. I.	....	5.8	48	25	1	50	150	..	..	0	....
Taylorville	5,000	.....	0	....	124	77	0	60	1.650	0	0	4	2½ to 4
Indiana													
Auburn	2,200	C. I. & W. I.	0	8	105	72	.....	41	780	0	0	40	2½
Bedford	6,000	C. I.	0	18	123	47	0	20	....	0	0	0	....
Butler	....	C. I.	0	4.5	37	16	.....	3	300	..	..	1	4
Evansville	30,281	C. I.	....	116.45	796	1,441	.....	1,062	11,463	0	0	..	4 & 6
Lebanon	2,000	C. I.	0	18	145—	137	.....	41	1,200	7	0	2	4 & 6
Logansport	1,700	C. I.	0	43	219	350	2 standpipes.	70	3,800	0	0	..	....
Portland	3,000	.....	0	11.5	123	....	.....	30	510	..	..	10	1½
Rushville	2,600	C. I.	0	10	119	95	0	80	1,100	2	1	2	4
South Bend	12,224	C. I.	....	106	1,039	1,018	.....	700	11,000	0	..	..	....
Union City	0	.....	0	11.5	107	Not known	0	55	1,309	0	..	5	2 & 4
Iowa:													
Cedar Falls	3,256	C. I.	0	18.94	122	152	0	68	1,270	0	..	..	....
Cherokee	10,110	C. I.	0	9.76	54	60	2 cranes	43	715	0	0	..	....
Fairfield	4,000	C. I.	0	12	67	77	1	24	620	0	0	5	6
Fort Dodge	8,300	C. I.	300	28	183	500	4 cranes.	250	2,300	0	0	10	2 to 6
Maquoketa	1,200	C. I.	0	13.5	112	76	1 crane.	35	1,200	0	0	0	....
Mt. Pleasant	2,700	C. I. & W. I.	0	10.5	73	40	0	48	442	0	..	2	2 & 4
Muscatine	5,280	C. I.	....	35	365	397	.....	213	3,000	..	..	6	6
Sioux City	26,486	C. I. & W. I.	9,000	81	555	785	7	664	7,000	..	..	14	4 & 6
Washington	2,500	C. I.	....	15	120	50	.....	84	852	0	0	10	1½
Kansas:													
Cherryvale	700	W. I.	0	26	107	45	2 cranes.	40	700	0	0	10	2, 4 & 6
Coffeyville	18,492	C. I.	0	42.5	171	220	0	123	2,098	0	0	8	2 to 6
Columbus	120	C. I.	0	10	83	20	1 crane.	120	600	0	0	1	2
Horton	....	.....	....	6	52	....	.....	20	220	..	..	..	....
Osawatomie	900	C. I. & W. I.	0	....	55	28	0	...	279	0	0	0	....
Ottawa	12,556	C. I. & W. I.	....	19.86	141	77	3	108	1,100	0	..	1	2
Pittsburg	18,335	C. I. & W.I.	3,154	44	265	438	3 cranes.	148	3,965	0	..	..	....
Pleasanton	0	.....	0	3	51	11	0	0	160	0	0	0	....
Washington	....	.....	....	....	51	3	.....	30	200	3	..	..	....
Wellington	....	.....	....	25	105	....	2 cranes.	32	1,250	..	..	12	2
Kentucky:													
Corbin	....	.....	....	....	....	325	0	...	...	0	..	0	....
Owensboro	4,500	C. I.	....	20	310	....	Standpipes.	150	3,500	..	..	12	4 to 8
Louisiana:													
Natchitoches	0	.....	0	5	39	14	3	50	500	0	0	6	1½
Maine:													
Dexter	12,000	C. I.	0	....	80	60	.....	56	600	0	2	2	2
Gardiner	1,672	C. I. & W. I.	....	....	60	229	3 standpipes.	21	1,397	..	..	11	4, 6 & 8
Pittsfield	....	.....	....	10	75	52	3 cranes.	6	570	..	..	3	6
Rumford	16,700	C. I.	0	21	74	84	2	16	...	0	0	..	....
Maryland:													
Baltimore	91,247	C. I.	42,330	741.19	3,589	....	0	4,401	146,000	0	0	731	3 to 10
Chestertown	0	.....	0	5	40	....	.....	40	340	0	0	0	....
Crisfield	....	.....	....	2	....	....	0	20	150	..	..	2	2
Massachusetts:													
Andover	3,765	C. I.	....	47.7	351	....	10 standpipes.	52	1,400	1	.	31	2½
Arlington	11,069	C. I.	1,350	44.85	444	403	0	107	2,409	..	..	2	6
Athol	1,500	C. I.	....	25	85	....	15 standpipes.	43	1,356	..	..	3	8
Belmont	18,423	C. I.	3,786	29.86	222	398	15 standpipes.	109	1,242	0	0	3	4 & 6
Brockton	11,982	C. I.	1,687	120.36	1,112	1,796	83	241	8,936	0	..	..	....
Brookline	9,671	C. I.	0	92.4	740	Unknown	Standpipes.	175	5,238	4	0	4	4 & 6
Cambridge	11,000	C. I.	4,154	138.227	1,140	....	73 standpipes.	201	16,395	..	..	172	4 to 8
Chicopee	10,303	C. I.	....	61.84	323	....	24 standpipes.	122	3,000	..	..	..	....
Clinton	1,093	C. I. & W. I.	0	37.8	191	271	12 standpipes.	15	1,830	0	0	24	4 & 6 d
Concord	6,263	C. I.	2,899	45.31	228	275	2	32	1,247	..	..	4	4, 6 & 8
Danvers	6,269	C. I.	2,170	59.3	300	516	13 standpipes.	60	3,325	0	0	12	4 & 6
Dudley	552	C. I.	0	9.352	86	54	.....	13	300	..	..	3	6
Easthampton	7,000	C. I.	....	30	283	200	4 standpipes.	53	1,420	2	7	75	4, 6 & 8
Everett	2,700	C. I. & W. I.	....	50	570	....	15 standpipes.	309	5,560	..	..	8	4 & 6
Gardner	7,560	C. I.	2,238	30.2	244	225	12 standpipes.	76	1,939	..	..	16	6 & 8
Haverhill	19,763	C. I.	0	105.58	401	1,328	Standpipe.	271	7,324	0	0	91	4 to 8
Ipswich	3,220	C. I.	....	24.18	170	149	6 standpipes.	16	975	..	..	3	4
Lexington	3,850	C. I.	0	33	164	125	12 standpipes.	102	1,063	0	0	15	4
Lowell	39,053	C. I.	16,543	154	1,350	1,800	20	163	13,108	0	0	100	2 to 8
Lynn	22,065	C. I.	15,706	153.58	....	....	Standpipes.	400	16,300	0	0	..	....
Maynard	841	C. I. & W. I.	....	12	106	170	2 standpipes.	17	991	0	..	3	2, 4 & 10
Medway	....	.....	....	....	111	87	0	63	394	..	..	3	6
Natick	4,244	.....	0	52.9	227	445	10	50	2,362	0	0	8	6

For footnotes see page 664.

TABLE NO. 3.—DISTRIBUTION SYSTEMS—MUNICIPAL—(Continued).

City.	Street Mains: Laid during year, feet.	Materials.	Discontinued during year, feet.	Now in service, miles.	Hydrants in service.	Stop gates in service.	Sprinkling cart appliances.	Service Connections: Added during year.	Now in use.	Motor and Elevator Connections: Added during year.	Discontinued during year.	Private Fire Connections: Number in use.	Sizes.
Massachusetts (Cont.)													
New Bedford	32,406	C. I.	8,599	158.359	1,257	2,060	39	418	14,055	0	4	120	2 to 10
North Attleborough	3,250	C. I.	0	34.5	259	402	Standpipes.	121	1,382	..	..	14	2 to 8
Northampton	19,057	C. I.	10,558	73.25	440	Unknown	20 standpipes.	66	3,300	..	..	..	....
Orange	4,054	C. I. & W. I.	0	16	138	147	1	12	878	0	0	8	4 to 8
Plymouth	2,220	Cement lined	0	54.4	219	616	30 standpipes.	34	2,589	0	0	6	4, 6 & 8
Reading	1,010	C. I.	0	32.319	191	292	8 standpipes.	60	1,565	0	0	6	6 & 8
Somerville	6,769	C. I.	4	98.69	1,115	1,599	80	241	12,827	0	0	40	2 to 8
South Framingham	4,009	C. I. & Gal.	677	42.24	249	537	14 cranes.	110	2,168	..	..	14	2 to 8
Springfield	40,061	C. I.	7,105	195.11	1,466	4,238	144e	422	13,407	..	..	..	....
Taunton	10,346	C. I.	0	94.1	1,029	728	28 standpipes.	106	5,526	0	0	30	4 to 12
Uxbridge	1,263	C. I.	....	13.2	132	....	3	24	425	..	..	9	8
Walpole	3,298	C. I.	....	29.44	219	126	5 cranes.	52	1,013	..	..	8	4 to 8
Waltham	12,966	C. I.	5,600	58.8	484	869	0	66	4,055	0	0	98	4 to 6
Ware	0	.....	0	12.87	126	134	10 standpipes.	6	897	0	0	8	4 to 8
Westboro	....	.....	....	16	105	....	3	25	775	..	..	12	....
Winthrop	5,916	C. I.	4,288	32.5	254	575	23 standpipes.	79	2,000	667	..	1	2
Michigan													
Alpena	1,560	W. I.	0	36.5	243	....	0	17	3.338	0	0	3	4 to 8
Battle Creek	26,768	C. I.	2,000	70	709	579	0	460	6,380	0	0	11	6 to 8
Boyne City	5,000	C. I. & W. I.	0	18	121	197	1 Eddy comb.	19	912	..	2	8	2
Crystal Falls	3,900	C. I. & W. I.	0	4	54	30	0	74	340	0	0	0	....
Flint	38,607	C. I.	4,318	65.3	368	652	12 standpipes.	425	5,731	..	..	26	....
Greenville	1,200	C. I.	....	10.8	73	70	0	19	890	0	0	2	6
Holland	2,466	C. I.	888	29.5	292	299	0	90	2,269	0	0	14	2 to 8
Ishpeming	780	.....	....	27	141	....	4 comb. fire hydrants and cranes.	19	1,636	..	..	..	....
Lansing	15,840	.....	0	83	511	640	20 standpipes.	500	8,208	0	0	15	4 to 6
Manistique	2,300	C. I.	....	9.1	73	73	.....	36	440	0	0	2	2½
Onaway	600	C. I.	....	6	42	18	0	25	380	4	1	25	2
St. Clair	0	.....	0	11	56	790	.....	10	...	0	0	..	....
Saginaw	19,500	C. I.	1,112	120	1,037	991	4 standpipes.	704	8,354	0	0	16	4 to 6
Ypsilanti	400	C. I.	0	28.2	169	210	4	44	1,957	0	1	6	2 to 6
Minnesota:													
Bemidji	750	C. I.	0	7.5	90	62	.....	31	374	..	..	4	2
Chisholm	10,000	.....	0	10	83	100	4	100	700	0	0	4	2 to 2½
Cloquet	1,595	C. I.	0	13.07	105	112	0	70	770	0	7	2	2
Duluth	26,627	C. I.	0	148.1	988	....	0	838	11,300	0	0	27	2 to 8
Fairmont	2,000	C. I.	0	5	53	17	5 cranes.	65	400	..	..	5	2
Faribault	7,736	C. I.	0	18.81	119	251	22 standpipes.	62	749	0	0	7	6
Lake City	8,228	C. I.	0	4.5	78	49	8 standpipes.	14	500	0	2	4	2
Minneapolis	123,552	C. I.	0	520	5,186	3,146	627	3,160	52,190	0	0	400	2 to 6
Montevideo	1,900	C. I.	0	7	102	....	2	...	400	..	..	..	....
Northfield	817	C. I.	....	9.2	91	65	.....	27	452	..	..	0	....
Owatonna	425	C. I.	0	16	106	100	4 special hydrants.	33	1,010	0	0	4	2 & 6
St. Paul	52,777	C. I.	0	374.047	3,372	3,129	566	1,912	34,563	..	..	177	4 to 6
St. Peter	....	.....	....	....	42	18	5 standpipes.	6	225	..	..	1	2
Stillwater	3,658	C. I.	0	15.5	170	....	.....	59	1,150	0	0	8	6
Thief River Falls	15,000	.....	....	6	47	25	Standpipe.	50	200	0	..	0	....
Mississippi:													
Canton	7,600	C. I.	0	15	95	125	.....	...	500	0	0	2	6
Clarksdale	0	.....	0	16	171	130	0	74	600	0	0	2	6 & 4
Grenada	....	.....	....	....	67	....	0	25	300	3	0	7	6
Hattiesburg	12,500	C. I.	0	....	180	118	Special attachment.	65	1,400	0	..	10	2 to 8
Jackson	30,000	C. I.	0	61	520	530	10 special attachments.	145	4,500	0	0	25	4 & 6
Meridian	29,040	C. I. & W. I.	0	46.5	416	296	.....	304	3,960	0	0	39	4 & 6
Water Valley	1,400	C. I.	0	16	89	150	.....	100	800	..	..	3	2 to 4
Yazoo City	8,000	W. I.	0	14.4	167	124	4	6	1,248	0	..	5	1 to 6
Missouri:													
Farmington	0	.....	....	4	35	10	0	15	...	..	..	..	....
Fulton	2,000	C. I.	0	....	65	50	1 pipe & valve.	35	820	0	..	3	....
Higginsville	3,000	C. I.	....	3.6	50	6	1	40	225	..	..	2	2
Kansas City	202,541	C. I.	360	508.33	6,244	5,950	0	3,469	51,444	0	0	306	2 to 6
Kirkwood	3,500	C. I. & Gal.	0	145	75	65	0	52	702	0	0	0	0
Montana:													
Miles City	....	C. I.	0	18	106	40	.....	130	750	0	0	0	....

Nebraska													
Alliance	0	.....	0	9.15	81	38	1 crane.	11	692	0	0	2	4
Blair	0	.....	....	5	43	20	2	30	400	0	0	0	....
Columbus	6,000	C. I.	0	10	79	100	.....	13	627	0	0	5	2½
Fairbury	0	.....	0	12	122	25	2	50	900	0	1	4	2
Hastings	2,662	C. I.	0	30	158	102	0	110	2,400	0	0	1	4
McCook	0	.....	0	13	53	45	.....	10	854	0	..	0	....
North Platte	3,000	W. I.	600	16.5	75	45	1 standpipe.	75	1,150	0	..	2	2
Schuyler	0	.....	0	5.5	45	29	3 cranes.	17	260	0	0	1	4
University Place	2,400	.....	0	8	58	28	0	68	778	0	0	0	....
Wahoo	800	C. I.	....	8	67	....	.....	22	525	..	..	..	....
New Hampshire:													
Claremont	15,966	C. I.	1,090	24.33	122	299	5 standpipes.	53	1,155	0	0	9	6 to 8
Concord	2,537	C. I.	48	70.09	504	1,021	41 standpipes.	42	3,792	0	0	19	2 to 10
Dover	5,020	C. I.	0	28.41	220	274	7 standpipes.	31	1,962	0	0	..	4 to 12
Keene	4,822	C. I.	....	45.5	292	463	0	52	2,179	..	..	..	....
Manchester	16,926	C. I.	0	134.9	958	1,329	70	247	7,597	..	..	73	46
Newmarket	0	.....	0	7	57	....	2 cranes.	7	450	0	0	0	....
Newport	700	Cement lined	0	19.6	83	118	0	28	...	1	1	4	4 & 6
Portsmouth	5,280	C. I.	0	23	208	....	0	48	2,896	0	..	3	6
New Jersey:													
Atlantic City	6,772	C. I.	....	82.16	864	....	0	224	6,965	0	0	20	4 to 8
Bridgeton	2,970	C. I.	0	34	324	480	0	120	3,098	0	0	43	....
Cape May	....	W. I.	....	18	120	....	.....	19	726	..	..	..	....
Dover	2,200	C. I.	0	26	160	300	0	87	1,440	0	0	5	6
Madison	....	.....	....	....	167	....	.....	...	...	..	..	0	....
New Brunswick	11,441	C. I.	0	56	362	1,035	0	304	5,287	0	0	15	2 to 6
New Mexico:													
Roswell	0	.....	0	28	132	84	0	117	1,200	0	0	15	2
New York:													
Auburn	4,244	C. I.	....	67.8	669	698	.....	109	8,309	0	0	50	4 to 12
Binghamton	9,892	C. I.	0	95.5	....	1,461	20 Matthews.	380	10,797	1	0	10	6 to 8
Canajoharie	700	C. I.	0	7.5	63	60	0	32	351	0	0	2	6
Carthage	0	.....	....	9.2	83	....	2 standpipes.	31	715	..	..	6	4 to 6
Catskill	0	C. I. & W. I.	0	15	131	139	.....	10	1,071	0	0	8	2 to 3
Corning	3,728	C. I.	0	27.141	273	322	2	81	2,753	0	0	17	3 to 6
Cortland	9,837	C. I.	0	253	231	241	1 Ludlow crane.	73	2,275	1	0	14	4 to 10
Dolgeville	1,000	C. I. & W. I.	0	9.5	72	132	0	27	640	0	1	4	4
East Syracuse	700	C. I.	0	....	66	....	.....	25	525	0	0	1	....
Fairport	0	.....	0	6	78	64	.....	49	752	0	0	3	4 to 6
Fort Plain	0	.....	0	15	74	41	1	12	700	0	0	7	4
Frankfort	2,500	C. I.	0	8.5	70	....	0	28	690	0	0	5	6 to 8
Geneva	0	C. I.	0	37.18	288	430	0	115	3,395	0	0	13	3 to 6
Glens Falls	6,836	C. I.	0	38.35	338	459	45 Heim valves.	98	3,470	0	0	25	1 to 6
Homer	0	.....	0	8	54	50	0	12	449	0	..	3	4
Hoosick Falls	3,000	C. I.	0	16	96	118	0	9	1,100	..	..	6	6 to 8
Jamestown	29,826	C. I.	6,454	99.6	497	750	2 cranes.	509	8,134	0	2	135	4 & 6
Lancaster	2,000	C. I.	....	20	105	200	6	30	840	0	..	50	3
Le Roy	.....	.....	....	12	110	75	4 cranes.	30	773	..	..	..	....
Lestershire	2,905	C. I.	0	10	85	165	5 cranes.	87	833	0	0	11	2 to 8
Little Falls	900	C. I.	0	20	150	255	6 special hydrants.	44	2,146	2	0	33	4 & 6
Malone	2,700	C. I. & W. I.	0	35.5	101	467	4 cranes.	70	1,610	0	0	4	6
Mechanicsville	2,500	C. I.	0	20	98	120	0	65	969	0	0	50	4 to 8
Newark	1,000	C. I.	0	16	150	....	0	136	1,245	0	0	6	4 & 6
Newburgh	1,956	.....	0	47.5	414	619	Standpipes.	78	4,745	0	..	..	2 & 4
New York City	....	.....	....	....	....	....	.....	...	...	..	..	..	....
Oneida	3,000	C. I.	0	20	133	185	0	96	1,034	0	0	0	....
Ossining	1,425	C. I.	0	23.8	190	169	0	141	1,874	0	0	5	2 to 4
Peekskill	1,000	.....	0	....	....	....	0	70	2,500	0	0	..	....
Plattsburgh	1,500	C. I.	0	40	240	....	.....	50	1,800	..	..	6	2-6
Poughkeepsie	14,952	C. I.	....	44	676	5,000	.....	319	5,000	2	..	10	4
Rochester	38,860	C. I.	7,603	460	5,200	8,000	.....	1,740	44,000	0	4	400	2 to 6
Salamanca	4,330	C. I. & W. I.	400	14.9	149	125	1	49	1,561	0	0	6	....
Solvay	6,000	C. I.	....	13	150	135	.....	39	840	..	..	4	4-12
Tarrytown	2,778	C. I.	591	25.18	240	374	0	21	962	0	0	9	4-6
Watkins	300	C. I.	0	10	80	102	2	10	560	0	0	6	1-8
Waverly	621	C. I.	0	14.28	68	91	16 cranes.	32	1,300	0	0	..	2-6
Whitehall	....	C. I.	....	8	59	69	.....	10	...	..	..	..	....
Yonkers	34,848	C. I.	3,275	148,337	1,645	1,083	0	374	8,964	0	0	..	....
North Carolina:													
Concord	1,000	C. I.	0	13	157	52	.....	0	0	0	0	12	6
Gastonia	17,845	C. I.	....	13.7	117	44	0	92	750	2	..	8	1-8
Lenoir	4,600	C. I.	0	14	120	50	1	60	400	2	..	6	2-6
Monroe	0	.....	0	8.25	66	43	0	25	521	0	0	2	4
Mooresville	0	.....	....	2	13	10	.....	9	70	..	..	..	....
Morganton	0	.....	0	8.5	51	25	1 standpipe.	25	280	0	..	2	6
Wilmington	1,704	C. I.	0	32	236	276	12 valves.	789	4,364	0	0	10	6 & 8
Wilson	2,700	C. I.	0	14.5	105	39	0	52	750	1	0	11	4 & 6

For footnotes see page 664.

TABLE NO. 3.—DISTRIBUTION SYSTEMS—MUNICIPAL—(Continued).

City.	Street Mains: Laid during year, feet.	Materials.	Discontinued during year, feet.	Now in service, miles.	Hydrants in service.	Stop gates in service.	Sprinkling cart appliances.	Service Connections: Added during year.	Now in use.	Motor and Elevator Connections: Added during year.	Discontinued during year.	Private Fire Connections: Number in use.	Sizes.
North Dakota:													
Grand Forks	1,800	C. I.	0	26.5	255	250	0	80	2,307	0	0	6	4 & 6
Wahpeton	300	C. I.	....	....	33	25	.....	25	582	..	..	..	....
Ohio:													
Alliance	13,000	C. I.	0	38	340	....	0	250	3,200	0	0	0	4-12
Ashland	6,000	C. I.	0	16	168	60	0	117	1,700	0	1	7	2 to 6
Canton	42,189	C. I. & W. I.	4,358	118.5	605	1,369	0	1,134	12,950	0	0	24	2-6
Celina	0	.....	0	12	127	....	2-in. tap.	65	632	0	0	2	6
Cincinnati	103,534	C. I.	14,558	688.24	.....	.....	0	1,938	55,498	..	..	..	⅝ to 6
Columbus	57,447	C. I.	0	313.4	2,249	3,136	0	3,519	33,738	1	0	155	4-8
East Cleveland	5,500	C. I.	....	35.9	415	787	0	250	....	..	..	..	....
Findlay	6,145	C. I.	0	53.33	262	208	Standpipes.	138	2,830	0	0	..	2-6
Hamilton	3,600	C. I.	480	79	600	412	.....	301	6,200	3	1	31	2-4
Leetonia	2,200	.....	0	6	80	50	0	24	580	0	20	3	....
Marietta	2,000	C. I.	0	33	255	275	.....	174	3,358	..	..	15	2-8
Medina	....	.....	....	10	65	62	.....	60	465	..	..	..	....
Millersburg	....	.....	0	5	52	30	1	7	450	..	..	..	....
Orville	4,700	C. I.	0	12	76	43	.....	32	974	0	..	3	6
Reading	0	.....	0	9.5	69	68	0	49	428	0	0	3	1-6
Salineville	10,560	C. I.	0	7.25	56	40	0	19	570	0	0	1	6
Springfield	15,840	C. I.	0	99.8	702	853	0	600	9,600	0	1	55	6-10
Toronto	1,000	C. I.	0	10	90	....	0	39	1,020	0	..	12	2½
Troy	3,050	C. I.	....	19	155	....	0	89	1,662	0	..	22	4-6
Wapakoneta	1,500	C. I.	....	....	121	....	1	50	835	..	..	5	1-8
Wauseon	0	.....	0	13	72	45	2-in. pipe hitch.	60	900	0	0	0	....
Wyoming	0	.....	0	18	65	64	0	23	354	0	0	0	....
Oklahoma:													
Davis	0	.....	0	4	....	....	1	15	165	0	0	2	2
Durant	10,000	C. I.	....	....	116	....	.....	30	600	..	..	3	4 & 6
Edmund	1,000	W. I.	0	37.850	54	26	1 gooseneck.	...	....	5	0	0	....
Guthrie	3,040	C. I. & W. I.	0	21	130	110	4 cranes.	12	1,387	0	0	30	2-6
Hartshorne	1,800	Gal.	....	....	....	....	.....	75	250	..	..	..	....
McAlester	500	C. I.	0	37	170	114	0	53	1,789	3	0	10	2 to 6
Oklahoma City	....	C. I.	....	145	770	53	0	120	11,500	..	..	50	4 & 6
Okmulgee	6,495	C. I.	0	18.05	170	58	0	250	1,150	0	0	8	¾-6
Tulsa	4,000	C. I. & W. I.	....	55	170	150	.....	809	4,000	..	..	25	2-6
Oregon:													
Eugene	6,000	W. I.	0	33	190	800	0	200	2,200	0	3	12	2 & 3
Medford	1,000	C. I.	0	28	286	700	0	40	2,040	1	0	6	2-4
Portland	352,126	C. I.	73,603	634.84	4,558	6,172	.....	1,421	55,902	..	..	204	6
Pennsylvania:													
Altoona	15,718	C. I.	0	89.3	814	1,876	15 stations.	222	13,215	0	0	13	2-6
Bradford	6,000	C. I.	0	39	296	....	0	94	3,977	..	0	18	2-6
Brookville	0	.....	....	9.5	40	60	.....	9	575	..	..	..	....
Chambersburg	3,895	C. I.	0	31	146	....	0	73	2,540	0	..	2	2-4
Coatesville	....	.....	....	....	....	....	.....	39	1,905	0	..	..	....
Doylestown	780	C. I.	....	....	80	260	.....	17	800	..	..	1	4
Duquesne	96	C. I.	0	21	133	....	0	53	1,578	0	3	0	0
Ford City	500	C. I.	0	6	50	25	0	10	450	0	0	3	4-6
Harrisburg	15,031	C. I.	1,692	91	1,097	2,045	.....	425	17,577	..	..	..	....
Hollidaysburg	0	.....	....	....	65	50	0	25	1,200	0	..	3	2-4
Juniata	0	.....	0	10	83	40	0	90	1,350	0	..	3	2
Lancaster	2,500	C. I.	0	71	700	1,155	21	125	12,500	0	2	9	4-10
McKeesport	9,269	C. I. & W. I.	158	67.52	478	934	0	133	6,267	0	0	14	4
Meadville	5,642	C. I.	....	34.99	187	331	4	113	2,977	0	..	10	2-6
Media	2,415	C. I.	0	....	75	105	0	5	1,225	0	1	0	....
Millvale	0	C. I.	0	85	85	73	0	46	1,266	0	0	6	2-4
North East	....	.....	....	15	60	65	.....	30	825	..	..	3	4
Reading	7,846	C. I.	14,268	113.6	985	3,002	0	289	22,792	217	..	..	1-8
Sharpsville	....	.....	0	3	90	....	.....	48	600	..	..	..	....
Shippensburg	0	.....	0	20	75	75	.....	32	1,300	0	..	10	¾-4
Steelton	7,000	Wood	....	17.5	127	4,000	0	30	25,000	0	..	2	4-6
Tamaqua	22,000	C. I.	0	32	89	127	.....	80	...	..	..	3	1-4
Rhode Island:													
East Providence	815	C. I.	0	21.5	66	....	4 cranes.	54	1,510	..	0	5	4
Providence	35,555	C. I.	2,281	411	2,489	4,577	67 hydrants.	892	30,051	5	0	600	4-10
Westerly	4,623	C. I.	0	38.25	195	253	0	84	2,018	0	0	10	6-8
Woonsocket	13,377	C. I.	1,468	62.4	713	773	54	226	3,625	2	0	80	4-12

South Carolina:													
Aiken	20	.....	0	13.04	78	45	2 standpipes.	15	852	0	0	3	2½ & 4
Cheraw	800	C. I.	0	6	39	....	0	108	108	1	..	1	6
Clinton	1,000	C. I.	....	9	75	33	2	130	410	..	..	3	6
Florence	....	.....	....	14.9	144	....	4 cranes.	129	1,085	..	..	1	6
Georgetown	....	.....	....	0	75	25	2	20	500	0	0	1	2
Rock Hill	600	.....	0	8	74	92	0	125	654	0	1	5	1-8
Sumter	900	C. I.	0	10	104	....	Crane.	75	1,132	3	0	..	....
Union	1,000	.....	0	16	75	42	0	60	360	0	0	2	6
South Dakota:													
Aberdeen	2,235	C. I.	0	26	170	180	0	92	2,200	..	..	12	4
Deadwood	0	C. I. & W. I.	0	8	76	75	0	0	550	0	0	3	1½
Huron	6,000	C. I.	....	13	95	80	2 cranes.	25	950	..	..	6	2-4
Mitchell	1,200	C. I.	0	11	86	56	2 cranes.	55	590	1	0	1	2½
Rapid City	....	.....	....	20	75	85	1	15	850	..	..	3	2
Tennessee:													
Clarksville	3,000	C. I.	....	15	140	110	0	37	1,070	0	0	10	2-8
Humboldt	0	C. I. & Steel.	0	7	450	14	2-in. valves.	20	450	0	0	1	8
Paris	2,000	C. I.	0	12	55	60	1	100	800	0	0	5	2
Tullahoma	3,400	W. I.	0	....	67	50	.....	...	...	..	..	0	2½
Texas:													
Ballinger	0	.....	0	10	....	50	3	3	450	0	0	2	4
Bay City	20,000	Wood	0	8	65	25	1	105	496	0	0	2	4
Brownwood	5,140	C. I.	....	12.5	208	80	6 cranes.	215	1,720	..	..	21	2-6
Cleburne	40,000	C. I.	0	25	123	83	.....	120	3,000	0	..	10	2-4
Denton	5,000	C. I. & W. I.	0	25	116	50	0	100	1,000	10	0	5	4
Georgetown	6,000	C. I.	0	5	47	30	0	25	650	0	0	2	4
Houston	23,571	C. I.	3,000	115.72	966	1,166	0	553	8,970	0	..	..	4-6
Longview	4,000	C. I.	0	5	100	20	0	25	400	..	..	1	....
Nagodoches	5,280	.....	0	15	175	0	20	125	550	3	0	..	3 & 4
Lufkin	1,700	C. I.	....	8	62	....	.....	54	385	..	..	..	....
Paris	4,000	C. I.	0	....	....	....	.....	200	1,700	..	..	15	4 & 6
Waco	....	.....	7,000	....	500	....	.....	837	9,500	0	0	24	4
Waxahachie	950	C. I.	0	11.38	79	74	0	...	...	0	0	4	2½
Utah:													
Ephriam	52,800	Wood Stave	0	20	20	30	Standpipe.	40	480	1	0	0	....
Nephi	0	.....	0	....	17	27	0	8	512	0	..	0	....
Salt Lake City	44,000	C. I.	0	227	1,803	3,118	0	711	18,529	0	0	205	2-6
Vermont:													
Barre	150	C. I.	0	65	123	160	8 standpipes.	32	1,693	0	0	10	2
Burlington	168	C. I.	0	41.89	252	709	.....	57	4,062	1	2	..	....
Virginia:													
Buena Vista	0	.....	....	....	650	..	0	20	650	0	0	5	2
Charlottesville	0	.....	0	22	89	97	4 standpipes.	57	1,639	0	0	5	2½
Clifton Forge	6,761	C. I.	0	7	52	32	4	28	1,149	0	0	2	4 & 2
Marion	0	.....	0	9.78	40	....	.....	40	430	..	..	2	2
Petersburg	8,000	C. I.	0	....	350	....	.....	600	5,200	0	0	20	3-8
Washington:													
Bellingham	....	Wood, C. I. & Gal.	..	79	250	....	.....	125	1,800	..	..	130	2½
Port Townsend	5,800	Wood	0	21	51	80	1 standpipe.	31	837	0	0	3	2 & 2½
Pullman	7,600	C. I. Universal	0	7.5	54	50	1	17	630	0	0	500	¾
Seattle	178,041	C. I.	76,032	635.35	5,343	5,196	50 standpipes.	2,284	43,578	..	20	260	2-6
Spokane	42,568	C. I. & Gal.	7,492	358,916	2,200	2,716	.....	514	21,722	..	..	..	....
Walla Walla	1,581	Steel	....	68	284	....	199	49	3,708	0	..	..	....
West Virginia:													
Fairmont	1,200	C. I.	0	25.5	159	181	2 standpipes.	136	3,461	8	1	2	2
Keyser	3,000	C. I.	....	....	51	....	.....	....	....	0	..	6	2
Martinsburg	2,500	C. I. & W. I.	0	15.5	156	142	0	102	2,250	0	0	9	4-6
Sisterville	10,700	C. I.	....	7	74	90	0	150	...	..	..	6	2
Wisconsin:													
Baraboo	1,870	C. I.	0	13.6	145	48	1 gooseneck.	32	1,083	0	..	0	....
Berlin	0	.....	0	10	84	48	3 goosenecks.	15	525	0	0	2	2½
Eau Claire	8,500	C. I.	....	42	430	250	.....	100	2,975	0	0	6	6
Ft. Atkinson	970	C. I.	0	8.7	102	90	2 standpipes.	73	731	0	0	4	4-6
Grand Rapids	7,228	C. I.	....	16	110	200	0	55	759	..	..	..	....
La Crosse	18,696	C. I.	3,000	66.4	551	702	27 standpipes.	175	4,553	0	0	9	6
Lake Geneva	1,628	C. I.	....	6.56	78	24	.....	27	340	..	..	4	2½
Marshfield	3,000	C. I.	....	14	120	100	3	40	600	2	..	3	6
Milwaukee	51,233	C. I.	358	505	3,420	3,737	0	2,181	59,603	0	6	146	4
Port Washington	6,500	C. I.	....	....	72	....	.....	...	483	..	..	3	4, 8 & 10
Sparta	656	C. I.	116	13.07	79	75	0	33	470	0	0	0	....

For footnotes see page 664.

TABLE NO. 3.—DISTRIBUTION SYSTEMS—MUNICIPAL—(Continued).

City	Street Mains: Laid during year, ft.	Materials	Discont'd during year, ft.	Now in service, miles	Hydrants in service	Stop gates in service	Sprinkling cart appliances	Service con's: Added during year.	Now in use.	Motor & elevator connections: Added during year.	Discontinued during year.	Private fire connections: No. in use.	Sizes.
Canada:													
Brantford, Ont.	15,925	C. I.	0	57.5	....	....	.....	330	6,448	0	0	32	4-8
Calgary, Alta.	132 000	Lap-weld	....	179.82	972	....	.....	1,587	9,066	2	1	143	3-6
London, Ont.	46,051	C. I.	0	116.4	767	753	0	708	13,978	0	0	24	6
Quebec, Que.	35,000	C. I.	0	80	700	1,200	0	250	9,000	0	0	25	2, 4 & 6
St. Catherines, Ont.	32,270	C. I.	....	52.25	365	628	21 columns.	514	4,405	0	..	35	4, 6 & 8
Toronto, Ont.	199,162	.....	7,946	526,028	6,007	4,910	0	6,398	96,030	..	..	427	2-12
Winnipeg, Man.	100,857	C. I.	....	258.93	2,079	3,961	Standpipes.	2,703	32,108	..	..	275	4 & 6

a—Also 647 fire cisterns. b—Also nearly 500 miles of 2-inch and 3-inch, to be replaced. c—Wrought iron for temporary use.
d—None less than 6-inch being made now. e—Also 30 car sprinklers.

TABLE NO. 4—DISTRIBUTION SYSTEMS—PRIVATE.

City.	Street Mains: Laid during year, feet.	Materials.	Discontinued during year, feet.	Now in service, miles.	Hydrants in service.	Stop gates in service.	Sprinkling cart appliances.	Service Connections: Added during year.	Now in use.	Motor and Elevator Connections: Added during year.	Discontinued during year.	Private Fire Connections: Number in use.	Sizes.
California:													
San Jose	50,323	C. I. & W. I.	0	168	495	...	0	906	11,308	0	0	101	2, 3 & 6
Stockton	20,600	C. I.	0	42	258	500	0	496	5,650	2	0	628	.....
Visalia	10,000	....	..	35	900	100	....	50	...	1	..	0	.....
Watsonville	5,484	....	..	12.17	78	235	....	48	1,248	0	0	..	.....
Connecticut:													
Litchfield	0	....	0	4	48	...	0	10	280	0	0	0	.....
Naugatuck	2,000	....	0	42	140	...	0	20	1,551	..	..	60	.....
New Canaan	2,774	C. I.	0	8.5	51	...	0	29	494	0	0	0	.....
Plainville	1,597	C. I. & Cmt. Ind.	0	11.76	50	45	0	13	401	0	0	3	4, 6 & 8
Portland	0	....	0	16	85	76	2	13	621	0	0	2	2½
Illinois:													
Carlinville	2,000	C. I.	..	7	76	35	0	20	500	..	..	...	.....
Effingham	0	....	0	14	101	35	1	20	395	0	0	0	.....
Harvey	...	....	..	.....	...	...	....	...	...	..	..	...	.....
La Grange	...	....	..	.....	...	...	....	...	...	..	..	...	.....
Lincoln	5,188	C. I.	..	22.2	238	152	....	141	1,466	..	..	4	1, 2, 3 & 6
Peoria	16,580	C. I.	0	113.57	1,481	991	1 flush hose connection	785	11,389	0	0	32	4, 6, 8 & 10
Pontiac	...	....	..	.....	...	...	....	...	...	..	..	...	.....
Quincy	6,783	C. I.	..	67.17	408	581	0	241	5,838	0	0	11	4 to 10
Streator	647	C. I.	0	38.14	279	242	2	131	23,874	0	0	3	6
Indiana:													
Greensburg	1,500	C. I.	0	15	165	50	2 goosenecks	40	1,000	0	0	0	.....
Indianapolis	95,677	C. I.	1,200	365	3,120	3,060	206 spec. connections	2,494	33,247	..	..	285	2 to 6
Jeffersonville	2,000	C. I. & W. I.	0	15	150	60	0	90	1,220	1	..	6	2 & 6
Linton	0	....	0	12	79	67	2 wagon cranes	40	1,350	..	..	...	.....
Richmond	13,373	C. I.	1,822	45.4	328	376	2 post hydrants	246	5,161	..	..	43	3 to 6
Seymour	1,320	C. I.	0	.....	156	...	1	110	1,050	..	..	5	2 to 6
Valparaiso	3,500	....	0	23	148	126	2 cranes	98	1,520	0	0	1	3
Vincennes	0	....	0	.....	282	75	0	...	...	0	0	...	2 to 8
Kansas:													
Cherokee	0	....	0	5.5	34	12	....	8	391	0	0	0	.....
Kentucky:													
Ashland	5,000	C. I.	0	20	140	...	....	...	2,300	1	1	...	.....
Bellevue & Dayton	2,307	C. I.	..	20.187	188	387	0	126	3,114	0	..	1	6
Hopkinsville	5,168	C. I. & Gal.	..	26.25	137	...	....	154	1,754	..	..	9	2 to 6
Maysville	900	C. I.	0	14.5	82	60	0	50	1,200	3	0	15	2"-8"
Middlesboro	7,920	C. I.	0	17	55	35	3 standpipes	102	951	0	1	3	4
Pineville	500	C. I.	0	10	300	20	5	35	400	0	..	22	3 & 4
Maine:													
Ellsworth	...	....	..	.....	...	...	....	...	...	..	..	...	.....
Maryland:													
Hagerstown	5,600	C. I.	..	38.7	102	326	6	76	4,780	0	1	10	4

Massachusetts:														
Bridgewater	...	....	..	17	75	80	....	49	778	..	..	...	.....	
Hudson	4,150	C. I. & Cmt.	..	2.743	186	150	7 standpipes	30	1,201	..	..	...	.....	
Whitinsville	0	....	0	13.5	165	128	3	2	650	0	0	...	.....	
Michigan:														
Alma	1,200	C. I.	0	8	92	40	....	25	500	..	..	10	2	
Iron Mountain	0	....	0	20	176	176	1 special tap	35	1,505	0	..	3	4	
Minnesota:														
Hutchinson	5,797	....	..	.....	45	...	....	30	...	..	..	...	.....	
Mississippi:														
Bay St. Louis	1,500	W. I.	..	12	33	11	0	40	425	0	0	0	.....	
Missouri:														
Carrollton	1,155	Universal	..	5.5	76	40	....	75	575	..	..	2	1 to 6	
Chillicothe	0	....	0	14.25	134	36	1 crane	75	1,200	0	0	2	6	
Montana:														
Livingston	...	....	..	12	111	133	2	25	1,261	..	..	23	1 & 2	
New Hampshire:														
Berlin	...	....	..	.....	77	140	Standpipes	50	1,380	0	0	2	6	
Walpole	...	....	..	.....	21	...	....	...	149	..	..	...	.....	
New Jersey:														
Somerville	3,774	C. I.	..	22.86	121	...	....	100	1,363	..	..	...	.....	
New York:														
Amityville	2,950	C. I.	0	11.5	84	86	3 standpipes	32	460	0	0	6	4	
Elmira	10,828	C. I.	0	95.75	566	955	....	361	8,073	..	..	22	3 to 6	
Ilion	2,290	C. I.	0	16.75	167	207	5 cranes	219	1,926	..	..	26	4 & 6	
Lyons	...	....	..	.....	59	...	....	...	...	..	..	..	.....	
Mt. Vernon	7,499	C. I.	129	70	696	970	0	101	5,313	0	0	3	6	
New Rochelle	402	C. I.	..	145.23	...	...	....	...	6,817	..	..	..	.....	
Seneca Falls	2,612	C. I. & W. I.	0	22	139	150	5 cranes	63	1,500	0	..	4	4½ to 8	
North Carolina:														
Henderson	...	....	..	.....	100	50	....	60	500	0	..	...	.....	
Ohio:														
Conneaut	5,162	C. I.	0	20.5	194	155	8 cranes	47	2,100	0	0	5	6	
Delaware	1,900	C. I.	..	23	266	142	0	87	2,050	0	..	2	6	
Washington C. H.	5,500	C. I.	0	18	158	80	0	52	1,192	0	0	7	6	
Pennsylvania:														
Carbondale	18,000	C. I.	4,000	58	150	575	0	150	4,500	0	..	20	4, 6 & 8	
Ellwood City	0	....	0	14	52	194	3 standpipes	18	1,108	0	0	12	4	
Galeton	...	....	..	.....	88	50	Taps on main	10	600	4	..	0	.....	
Gettysburg	1,800	C. I.	..	15	54	97	0	20	700	0	0	2	2 & 6	
Hanover	4,000	C. I.	0	42	120	377	0	136	2,670	0	1	16	4 & 6	
Hazleton	2,000	C. I.	..	30	73	150	....	100	2,500	..	..	1	8	
Indiana	3,000	C. I. & W. I.	0	18	82	...	0	70	1,263	0	0	3	4	
Jersey Shore	...	....	..	.....	63	...	....	...	...	..	..	...	.....	
Lehighton	0	....	0	21	65	20	0	28	1,090	6	0	0	.....	
Lewistown & vicinity	144	C. I.	0	65	225	...	....	45	3,450	0	0	35	1 to 4	
McDonald	0	C. I.	0	9	43	50	0	22	500	0	0	0	.....	
Meyersdale	0	....	0	12	33	26	0	5	800	0	0	1	1½	
Minersville	0	....	0	14	58	150	....	150	2,200	0	0	2	4 & 6	
Parkesburg	0	....	0	8	25	25	....	12	475	..	..	...	.....	
Sayre	675	C. I.	0	26	99	...	0	76	2,525	0	0	3	4 & 6	
Shamokin	8,776	C. I.	0	60.30	127	422	....	189	4,157	0	0	75	2, 3 & 4	
Towanda	...	....	..	29.5	67	...	6	20	1,261	..	..	10	4 & 6	
West Newton	0	....	0	8	52	68	0	28	425	0	0	2	2 & 6	
Wilkinsburg	...	....	..	152	687	2,400	0 a	403	13,237	..	..	10	2 to 12	
South Carolina:														
Charleston	0	....	..	.....	625	...	....	...	...	0	0	5	6	
Texas:														
Navasota	...	....	..	7	46	12	....	...	600	..	..	4	6	
San Angelo	10,000	C. I.	0	32	81	44	....	60	1,585	0	0	24	2 & 4	
Stamford	...	....	..	10	480	...	1	...	480	..	..	...	.....	
Wisconsin:														
Ashland	387	W. I.	0	30.7	246	203	0	15	198	0	0	7	4 & 6	
Green Bay	7,649	C. I.	..	56	416	476	0	226	4,811	0	0	9	2 to 6	
Ripon	596	C. I.	..	11.5	105	51	0	13	752	0	0	1	6	
Superior	19,889	C. I.	0	61.8	782	...	0	417	5,943	0	0	46	6	
Washburn	0	....	0	6.5	76	...	....	...	...	..	..	...	.....	

a—Expect to install 50 this season.

TABLE NO. 5—METERS AND RATES. MUNICIPAL.

City	Kind on fire connections	Service meters: No. added during year	Service meters: Number now in use	Consumers: Do Own meters?	Consumers: Maintain meters?	Cost per year of maintenance, etc.	Reduction in consumption	Meter Rates: Cents per 1,000 gals. Maximum	Meter Rates: Minimum	Rates for private fire service
Alabama:										
Mobile	Detector	1,007	2,735	No	No	....	Yes	..	..	.....
Talladega	.....	42	600	No	No	$0.22	About 50%	..	..	.....
Arizona:										
Globe	None	40	1,200	No	No	1.00	Yes	..	..	.....
Arkansas:										
Batesville	Worthington piston	43	437	Yes	No	1.10	35%	30	15	Meter rates
Fayetteville	None	500	550	No	No	....	30%	35	7½	.....
California:										
Lodi	.....	0	4	Yes	Yes	....	.....	15	15	No charge
Los Angeles	Compound	4,693	58,896	No	No	.238	Yes, 55%	9⅓	9⅓	a
Oxnard	None	..	4	No	No	....	.....	10	7	None
Redlands	Turbine	117	156	No	No	....	.....	16⅔	10	Meter rate
San Diego	⅝" By-pass	1,676	14,153	No	No	....	.....	..	..	$12
Tulare	None	5	45	No	No	.25	25%	..	..	.....
Whittier	.....	10	385	Yes b	Yes b	....	.....	4	4	.....
Colorado:										
Colorado Springs	None	11	224	Yes	No	....	.....	15	8	.....
Fort Morgan	None	0	0	....	....	....	.....	..	..	.....
Grand Junction	.....	2	10	Yes	Yes	0	.....	..	..	$12
Greeley	.....	9	100	Yes	Yes	....	Yes	..	..	25
Montrose	None	9	20	Yes	Yes	....	.....	..	..	.....
Silverton	None	3	11	Yes	Yes	....	Yes	45	10	0
Connecticut:										
Bristol	None	144	1,483	No	No	.30	50%	..	..	.....
New Britain	None	173	4,824	No	No	....	Yes	10 c	5½ c	.....
New London	None	53	878	No	No	1.45	.....	12 c	4½ c	No charge
Putnam	Hersey detector	0	97	Detectors only	Detectors	....	.....	20	10	$1 per 1,000 sq. ft.
Southington	None	11	85	4 only	4 only	....	25-50%	..	..	$20 and 2c. d
South Norwalk	None	..	152	No	No	....	.....	7½	5	None
Waterbury	None	25	1,527	A few	No	....	.....	20	10	$1 per hose connec.
Willimantic	None	80	1,238	No	No	....	Yes	..	..	None
Winsted	None	..	119	No	No	....	50%	9	4	None
Delaware:										
Dover	None	0	0	....	....	....	.....	..	..	.....
Wilmington	.....	1,121	8,695	....	....	....	.....	7½ c	3½ c	.....
District of Columbia	Detector	10,150	33,656	3,206	3,206	....	.....	6 c	4 c	Meter rates
Florida:										
Bartow	Disc	30	200	No	No	....	Yes	25	10	None
Daytona	None e	131	478	No	Yes f	.20	.....	10 f	10 f	0
Jacksonville	Hersey detector and Neptune protectus	460	7,828	Larger than 1½"	No	....	Yes	8 c	4 c	$12.00
Key West	None	No	...	....	....	....	.....	..	..	.....
Marianna	.....	12	107	Yes	Yes	.26	.....	25	12	Meter rates
Ocala	.....	..	..	Yes	No	....	.....	..	..	.....
St. Petersburg	Trident compound	250	1,650	Yes	No	.61	25%	20	20	0
Georgia:										
Americus	Hersey detector	87	461	Yes	Yes	.45	Unquestionably	20	11¼	$25.00
Athens	None	80	1,360	Yes	No	....	50%	25	12½	$50 per hyd.
Augusta	Keystone, Hersey, National, Lambert	20	..	Yes	Yes	....	Yes	10	4	None
Bainbridge	None	15	164	Yes	No	1.00	.....	..	..	.....
Griffin	None	130	610	No	No	....	.....	15	15	$120.00 g
Madison	.....	20	185	No	No	....	.....	20	12½	.....
Statesboro	.....	50	50	No	No	....	Yes	25	15	.....
Thomasville	Lambert	53	741	Yes b	No	.55	.....	15	15	0
Illinois:										
Blue Island	None	10	45	No	No	....	.....	20	20	None
Bridgeport	Keystone	..	190	Some	Some	....	.....	..	..	.....
Canton	.....	50	1,700	Yes	Yes	2.00	Yes	30	25	.....
Chicago	.....	959	16,969	....	....	....	.....	..	..	.....
Decatur	None	300	5,518	Yes	Yes	....	Yes	..	..	None
Highland Park	Ash, Empire, Trident	38	950	No	No	.30	.....	12 c	12 c	Meter rate
Hinsdale	.....	50	750	Yes	Yes	.13⅓	.....	25	10	.....
Mattoon	None	..	123	No	No	.10	.....	25	5	.....

Naperville	.....	38	614	Yes	Yes	....	.....	10 c	10 c	.....
Rockford	None	536	8,652	Yes	No	....	.....	15 c	9 c	None
Rock Island	None	470	1,460	No	No	$0.72	35%	12 c	6 c	None
Salem	.....	..	150	Yes	Yes	....	.....	30	..	.....
Taylorville	Crown	50	450	Yes	Yes	....	Yes	25	15	.....
Indiana:										
Auburn	None	0	0	....	....	....	.....	..	..	.....
Bedford	None	0	18	No	No	....	.....	40	7	.....
Butler	None	..	250	No	No	2.00	Yes	50	10	None
Evansville	None	10	51	No	No	....	.....	20	5	None
Lebanon	None	57	141	No	No	.20	Yes	25	8	.....
Logansport	None	0	0	....	....	....	.....	..	..	.....
Portland	None	0	10	No	No	....	.....	25	18	$21.50
Rushville	None	70	179	No	No	1.00	50%	25	..	.....
South Bend	Hersey detector	..	3,032	No	No	....	.....	12	8	None
Union City	None	50	711	145	No	....	Yes	10 c	6 c	None
Iowa:										
Cedar Falls	None	64	802	22	No	....	Yes	22½ c	5.85 c	.....
Cherokee	None	48	715	Yes	Yes	....	Yes	25	..	None
Fairfield	None	37	493	No	No	.25	Yes	40	15	Free
Fort Dodge	None	183	2,300	Yes	Yes	....	Yes	50	8	Free
Maquoketa	.....	500	1,200	No	No	.07	50%	16%	6	.....
Mt. Pleasant	Trident crest, Trident disc	48	442	No	No	.20	.....	50	20	Meter rates
Muscatine	None	100	220	No	No	....	.....	35	8	50.00
Sioux City	None	664	6,886	No	No	....	Yes	25	10	....
Washington	None	84	852	Yes	Yes	....	10%	..	..	None
Kansas:										
Cherryvale	Eureka	150	200	No	No	.50	Yes	50	10	150.00
Coffeyville	None	132	1,043	No	No	1.00	Yes	15	4	36.00 g
Columbus	Keystone	100	315	Part	Part	.60	Yes	40	15	None
Horton	.....	20	220	No	No	....	40%	45	27	.....
Osawatomie	.....	...	210	Yes	No	....	.....	30	5	None
Ottawa	None	71	446	Yes	Yes	....	.....	35	5	3.00
Pittsburg	.....	49	1,011	Yes	Yes	....	Yes	40	9	.....
Pleasanton	.....	0	2	Yes	Yes	....	.....	..	..	.....
Washington	.....	200	200	No	No	....	.....	..	..	.....
Wellington	.....	37	1,250	Part	Part	....	.....	15	6	.....
Kentucky:										
Corbin	.....	0	0	.....	.....	....	.....	..	..	.....
Louisville	None	1,290	4,312	No	No	....	.....	10	4	.....
Owensboro	None	...	1,000	No	No	....	.....	25 c	3 c	$40 to $80
Louisiana:										
Natchitoches	National, Hersey	50	350	Yes	No	1.00	25%	35	10	None
Maine:										
Dexter	None	25	323	No	No	1.55	.....	35	16½	Meter rates
Gardiner	.....	0	0	....	....	....	.....	..	..	.....
Pittsfield	.....	0	0	....	....	....	.....	..	..	.....
Rumford	.....	2	62	No	No	.25	.....	30 c	20 c	.....
Maryland:										
Baltimore	None	300	3,600	25%	25	....	.....	7.8 c	0.9 c	Free
Chestertown	None	1	5	Yes	Yes	.75	.....	..	..	.....
Crisfield	.....	20	150	Yes	Yes	1.33	.....	..	..	.....
Massachusetts:										
Andover	Neptune	65	1,146	Optional	No	....	.....	..	..	None
Arlington	Hersey compound	481	2,438	No	No	.60	25%	15 c	15 c	Meter rates
Athol	None	0	58	No	No	....	No	25 c	5 c	Free
Belmont	Detector h	107	1,242	Optional	No	....	Very little	20 c	15 c	.....
Brockton	None	252	8,918	No	No	.87	.....	17 c	10 c	None
Brookline	None	200	5,200	No	No	....	Yes	12 c	12 c	Free
Cambridge	Hersey detector	317	5,300	No	No	1.50	.....	15 c	8 c	.....
Chicopee	Hersey detector	166	1,352	No	No	....	.....	..	..	.....
Clinton	None	29	1,629	No	No	.81	.....	25 c	6½ c	None
Concord	Hersey detector	6	36	No	No	....	.....	20 c	7½ c	Meter rates
Danvers	Hersey detector	...	40	No	No	....	.....	10	6	Free
Dudley	None	...	...	Yes	Yes	....	No	40	40	None
Easthampton	None	152	403	No	No	....	.....	12 c	12 c	.....
Everett	None	300	2,260	No	No	....	.....	12½ c	8 c	Free
Gardner	None	5	136	No	No	....	.....	30	15	None
Haverhill	None	280	1,812	No	No	.67	Yes	..	..	.....
Ipswich	National	25	515	No	No	....	Yes	..	..	Free
Lexington	None	91	843	No	No	....	16%	22 c	15 c	$10.00
Lowell	Hersey detector	293	10,863	Yes	Yes	....	35%	14 c	10 c	Free
Lynn	None	400	7,500	Yes	No	....	.....	15	10	Free

For footnotes, see page 671.

TABLE NO. 5—METERS AND RATES. MUNICIPAL—Continued.

City	Kind on fire connections	Service meters: No. added during year	Service meters: Number now in use	Do Consumers Own meters?	Do Consumers Maintain meters?	Cost per year of maintenance, etc.	Reduction in consumption	Meter Rates: Cents per 1,000 gals. Maximum	Meter Rates: Minimum	Rates for private fire service
Massachusetts—(Cont.)										
Maynard	None	14	986	No	No	....	Yes	37½ c	10 c	None
Medway	None	..	173	No	No	....	.....	30 c	10 c	Free
Natick	None	99	1,821	No i	Yes	....	Yes	25	15	Free
New Bedford	None	2,342	12,340	No i	No	....	Yes	11¼ c	7½ c	Free
NorthAttleborough	None	21	1,382	Yes	Yes	$3.00	.....	60	15	Free
Northampton	None	11	128	No	No	....	.....	10	6	Free
Orange	None	12	178	Yes	No	.35	Yes	25 c	20 c	Free
Plymouth	Detector	..	171	70	70	....	.....	20	10	Free
Reading	None	67	1,457	No	No	.475	Yes	..	..	Free
Somerville	None	685	7,856	No	No	....	26%	12 c	8 c	None
South Framingham	Gem	159	2,222	No	No	.83⅓	Yes	25 c	9 c	$15 to $80
Springfield	Detector	1,573	9,970	Yes	No	....	.....	22 c	5 c	Free
Taunton	None	148	3,085	Yes	No	....	.....	25	9	Free
Uxbridge	.....	30	356	Yes	Yes	....	.....	..	..	10c. per sprinkler head.
Walpole	None	90	744	No	No	1.00	Yes	30	..	Free
Waltham	None	300	1,000	No	No	....	Slightly	..	..	.....
Ware	None	6	918	No	No	....	50%	..	..	None
Westboro	.....	25	675	19	No	1.00	No	30	..	.....
Winthrop	Empire	79	2,667	No	....	.58	50%	20	20	19c. per 1,000 gals.
Michigan:										
Alpena	None	8	89	Yes	Yes	.94	Yes	10	4	.....
Battle Creek	Hersey detector	460	6,236	i	No	....	Yes	13	4	$25.00
Boyne City	None	12	46	No	No	.20	.....	10	4	Free
Crystal Falls	None	0	1	No	No	5.00	.....	6	..	.....
Flint	.....	...	3,353	No	No	....	.....	20	5	.....
Greenville	None	0	...	No	No	....	.....	25	6	.....
Holland	Hersey detector	90	2,277	No	No	....	.....	8	4	None
Ishpeming	.....	57	1,617	No	No	....	Decidedly	10	4	.....
Lansing	National, Worthington	301	5,400	No	No	....	33%	40	5	Meter rates
Manistique	Hersey detector	1	15	No	No	1.25	Yes	35	7	None
Onaway	None	3	18	No	No	.10	Yes	30	20	Free
St. Clair	None	0	0	....	....	....	.....	..	..	.....
Saginaw	Hersey detector	4	343	No	No	2.60	.....	11	4	Free
Ypsilanti	None	63	912	No	No	.17	40%	25	8	$75.00
Minnesota										
Bemidji	None	31	374	Yes	Yes	....	.....	30	9	None
Chisholm	None	0	2	No	No	....	.....	..	..	.....
Cloquet	None	70	770	Yes	Yes	....	.....	50	9	None
Duluth	Various	912	7,525	Yes	Yes	.50	Yes	15 c	8 c	$96 to $36
Fairmount	None	65	395	Yes	Yes	....	25%	35	7	Free
Faribault	None	62	749	No	No	.305	.....	40	10	Free
Lake City	None	8	400	Yes	Yes	1.85	.....	30 c	..	None
Minneapolis	None	3,657	43,180	Yes	Yes	.70	33%	8	8	5.00
Montevideo	None	...	390	Part	Part	....	.....	20 c	10 c	Free
Northfield	None	200	429	Yes	Yes	....	Yes	15 c	5½ c	.....
Owatonna	Crown	17	75	No	No	....	.....	30	8	$5 to $80
St. Paul	Hersey detector	7,591	26,661	No	No	....	2% in one year	6 c	..	$25 to $50
St. Peter	None	6	224	Yes	Yes	....	.....	30	15	.....
Stillwater	None	0	0	...	...	....	.....	..	..	$100
Thief River Falls	Trident disc	50	200	Yes	Yes	....	.....	50	20	None
Mississippi:										
Canton	.....	2	4	No	No	....	.....	..	..	$35.00 per hyd.
Clarksdale	None	40	225	No	No	.25	Yes	25	15	6.25 per hyd.
Grenada	None	55	467	Yes	Yes	....	Yes	40	18	None
Hattiesburg	Hersey detector	...	15	No	No	....	.....	25	10	10c. per thousand
Jackson	.....	480	1,840	No	No	.12	.....	20 c	7 c	None
Meridian	None	304	2,400	No	No	.80	Yes	30	5	$25 and 5c. d
Water Valley	Hersey detector	100	800	No	No	3.80	50%	33⅓	25	None
Yazoo City	None	600	1,024	No	No	....	50%	25	7	$5 to $35 and 10c. per 100 sq. ft.
Missouri:										
Farmington	.....	...	350	Yes	Yes	.25	Yes	25 c	12 c	.....
Fulton	.....	22	372	Yes	Yes	....	.....	..	15 c	None
Higginsville	Lambert	30	57	Yes	Yes	....	Yes	40	25	None
Kansas City	None	3,000	25,344	Two-thirds	Yes	.78	Yes	25	7½	$60
Kirkwood	None	52	702	Yes	Yes	....	.....	..	..	.....
Montana:										
Miles City	None	650	650	No	No	....	Yes	..	..	.....

Nebraska:										
Alliance	None	11	692	Yes	Yes	....	.....	18	8	Free
Blair	None	60	375	No	No	.35	Yes	35	15	.....
Columbus	None	13	622	Yes	Yes	....	.....	20	..	None
Fairbury	None	50	900	Yes	Yes	1.00	Yes	15	10	.....
Hastings	None	110	2,400	Yes	Yes	....	.....	16	13	.....
McCook	.....	10	854	Yes	Yes	....	.....	12 c	12 c	.....
North Platte	Hersey disc	450	530	Yes	Yes	....	Yes	15	7	None
Schuyler	Trident compound	17	260	No	No	1.25	.....	25	10	None
University Place	None	68	778	Yes	Yes	....	.....	25	15	None
Wahoo	.....	12	375	Yes	No	....	Yes	25	9	.....
New Hampshire:										
Claremont	None	60	668	No	No	.65½	.....	20	10	$20 and 7½c.
Concord	None	76	2,318	No	No	....	Yes	22½	5	Free
Dover	None	53	1,432	Most	Most	1.80	Materially	22½ c	15 c	Free
Manchester	None	264	5,952	No	No	....	Yes	10 c	7 c	Free
Newmarket	None	11	57	Yes	Yes	....	.....	30	..	None
Newport	None	3	4	No	No	....	.....	25	13½ c	Free
Portsmouth	None	45	293	No	No	....	.....	20	10	None
New Jersey:										
Atlantic City	Hersey detector	583	6,590	No	No	....	Yes	12	..	Free
Cape May	Pittsburg	4	9	No	No	....	.....	15	15	.....
Dover	None	100	1,200	No	No	.30	15%	22 c	16 c	None
Madison	.....	...	...	Yes	Yes	....	.....	22½	..	.....
New Brunswick	Keystone, Crest, Empire, Eureka	241	1,819	No	No	....	.....	..	..	.....
New Mexico:										
Roswell	Keystone, Neptune (disc)	400	1,200	Yes	No	.23	.....	..	..	Meter rate
New York:										
Auburn	Hersey factory	48	750	No	No	....	.....	12½ c	3½ c	Free
Binghamton	.....	1,091	4,746	Yes	No	....	.....	10	6	Free
Canajoharie	National	7	6	Yes	Yes	....	.....	30	3	Meter rate
Carthage	None	10	300	Yes	Yes	....	Yes	36 c	6 c	Free
Catskill	None	5	180	No	No	1.00	33⅓	10	..	.....
Corning	None	120	2,721	No	No	.4348	Yes	28	7	$8.40 to $15
Cortland	Hersey detector	127	1,662	Yes	Yes	.09	.....	40	4¾	$25 to $250
Dolgeville	None	0	0	....	....	....	.....	..	..	.....
East Syracuse	.....	200	350	Yes	Yes	....	.....	30 c	5 c	.....
Fairport	None	40	603	Yes	Yes	....	.....	20	10	$50
Fort Plain	None	1	47	No	No	.50	Slightly	15 c	2 c	None
Frankfort	None	60	165	Yes	Yes	....	Yes	28	7	Free
Geneva	None	97	3,047	No	No	.16	Yes	..	..	.....
Glens Falls	Hersey detector, compound	6	41	No	No	....	No	12 c	2½ c	Free
Homer	.....	4	71	Some	Yes	....	.....	25	15	.....
Hoosick Falls	None	1	21	Yes	Yes	2.00	.....	33⅓	21	Free
Jamestown	Detector on sprinklers, current on standpipes	864	6,707	No	Only for carelessness	.30	Yes	15 c	15 c	Free
Lancaster	None	50	892	Yes	Yes	.20	.....	..	..	.....
Le Roy	.....	...	360	No	Damage only	....	.....	..	..	.....
Lestershire	None	91	833	Yes	No	.45	.....	..	..	Free
Little Falls	Detector	3	334	No	No	2.00	Materially	16 c	2½ c	Free
Malone	None	0	0	....	....	....	.....	..	..	.....
Mechanicsville	None	65	1,008	Yes	Yes	1.00	50%	..	..	.....
Newark	None	146	943	No	Yes	....	.....	20	8	$5
Newburgh	None	0	0	....	....	....	.....	..	..	.....
Oneida	.....	96	1,000	Yes	Yes	....	.....	25	6	.....
Ossining	None	141	1,667	Yes	No	....	Yes	15 c	..	None
Peekskill	None	70	2,000	Largest	No	....	.....	10 c	5 c	Free
Plattsburgh	.....	10	100	No	No	....	Yes	10	6	.....
Poughkeepsie	None	270	5,000	No	No	....	Yes	12½ c	4 c	None
Rochester	Hersey detector	1,740	43,888	Yes	No	.40	Yes	14	10	Free
Salamanaca	None	21	21	No	Yes	....	.....	25	5	Free
Solvay	None	39	840	Yes	Yes	.30	45%	20	12½	Free
Tarrytown	Crown	...	1,016	Yes	Yes	.....	.....	30 c	15 c	15 c
Watkins	None	10	550	No	No	.82	Yes	30 c	12 c	None
Waverly	None	20	425	Yes	Yes	....	.....	..	..	.....
Whitehall	.....	75	700	Yes	Yes	.35	Yes	40	7	.....
Yonkers	None	335	9,221	Yes	....	....	.....	15	6	.....
North Carolina:										
Concord	Hersey detector	60	...	No	No	....	No	31½	8	$40
Gastonia	None	103	476	No	No	....	Yes	25	8	Free
Lenoir	None	400	400	No	No	....	40%	30	20	Free
Monroe	Hersey detector	25	520	No	No	.55	.....	50	..	.30 per 1,000 gals.
Mooresville	.....	9	35	No	No	.25	.....	30	10	None
Morganton	None	20	230	No	No	....	Yes	20	10	$25
Wilmington	Compound	48	1,448	No	No	....	Yes	10 c	6 c	$6 to $4 and $40
Wilson	None	52	750	No	No	.75	.....	..	..	Free

For footnotes, see page 671.

TABLE NO. 5—METERS AND RATES. MUNICIPAL—Continued.

City	Kind on fire connections	Service meters: No. added during year	Service meters: Number now in use	Consumers: Do Own meters?	Consumers: Maintain meters?	Cost per year of maintenance, etc.	Reduction in consumption	Meter Rates: Cents per 1,000 gals. Maximum	Meter Rates: Minimum	Rates for private fire service
North Dakota:										
Grand Forks	None	64	1,841	Yes	Yes	.12	50%	50	6½	Free
Wahpeton	.....	...	15	No	Yes	....	.....	..	..	.....
Ohio:										
Alliance	.....	25	200	No	No	....	Yes	20	4	Meter rate
Ashland	None	125	1,660	No	No	....	33%	30	6½	Free
Canton	Detectors and compound	280	1,186	No	No	....	.....	6	..	.....
Celina	None	0	0	....	....	....	.....	..	..	.....
Cincinnati	None	5,677	31,166	Yes	Yes	....	.....	8 c	8 c	Free
Columbus	Hersey detector	2,158	28,851	Yes	No	.69	.....	9 c	8 c	$3 per hyd.
East Cleveland	.....	200	2,719	Yes	No	.66	20%	7 c	..	.....
Findlay	Detector	175	2,830	No	No	.50	33%	24	8	None
Hamilton	.....	500	7,000	Part	Part	....	Yes	..	..	$12
Leetonia	.....	...	...	Yes	Yes	....	.....	..	..	$10
Marietta	None	30	500	No	No	.....	.....	30	4	Free
Medina	.....	75	400	No	No	1.00	Yes	25	..	Free
Millersburg	None	0	2	No	No	....	.....	7	4	.....
Orville	Hersey detector	32	975	No	No	.08	Yes	20	5	Free
Reading	Crown, Hersey	49	428	Yes	Yes	....	Yes	20 c	5 c	.....
Salineville	None	0	20	No	No	1.95	90%	25½	5½	None
Springfield	None	500	2,300	Yes	No	1.34	Yes	10	6	Free
Toronto	None	5	60	No	No	....	.....	50	7	Free
Troy	None	55	576	No	No	....	.....	12	6	Free
Wapakoneta	None	45	600	Yes	Yes	....	.....	25	6	Free
Wauseon	None	200	750	Yes	Yes	....	33%	25	..	.....
Wyoming	.....	23	354	Yes	No	.75	.....	20 c	8 c	.....
Oklahoma:										
Davis	None	36	55	No	No	....	15%	33⅓	10	Free
Durant	.....	...	100	No	No	....	50%	15	6	.....
Edmond	.....	58	287	No	No	.60	.....	25	13	.....
Guthrie	Keystone, Empire	220	1,058	No	No	....	.....	20	10	$5 to $50
Hartshorne	.....	50	200	No	No	....	.....	..	..	.....
McAlister	None	53	1,789	No	No	.06	Yes	37½	20	None
Oklahoma City	None	2,000	11,000	No	No	....	Yes	20	7½	None
Okmulgee	Compound	250	1,150	No	No	....	Yes	45	8	Free
Tulsa	Eureka, Keystone	815	1,100	No	No	....	Yes	25	8	Free
Oregon:										
Eugene	None	400	800	No	No	.95	Materially	25	25	.....
Medford	None	25	80	Most	No	....	.....	30	12	Free
Portland	None	177	13,398	Large ones	Large ones	.122	.....	12½ c	8 c	$12 to $60
Pennsylvania:										
Altoona	Eureka, Hersey detector	84	680	Yes	Yes	....	Yes	25 c	3 c	Free
Bradford	None	6	120	No	Yes	....	.....	6	4	None
Brookville	.....	...	33	No	No	....	.....	..	..	.....
Chambersburg	None	78	483	Yes	Yes	.18	Yes	12½	3¼	None
Coatesville	.....	0	33	....	No	....	.....	..	..	$20
Doylestown	Hersey	12	20	No	No	....	.....	..	..	.....
Duquesne	.....	53	1,778	No	No	1.60	Yes	20	15	None
Ford City	Hersey	10	450	No	No	....	50%	20	..	.....
Harrisburg	None	442	11,544	Yes	Yes	.09	.....	..	..	Free
Hollidaysburg	None	0	0	....	....	....	.....	..	..	.....
Juniata	Pittsburgh	...	3	No	No	....	.....	4		
Lancaster	None	359	4,343	Yes	Yes	.21	Yes	..	5	.....
McKeesport	None	192	3,798	Most	Yes	.57	Yes	20 c	7 c	.....
Meadville	None	310	2,074	Yes	Yes	....	Yes	15 c	5 c	Free
Media	None	0	13	No	No	....	.....	15	10½	.....
Millvile	None	3	7	Yes	Yes	....	.....	..	..	.....
North East	None	8	70	Yes	No	....	.....	10	5	Free
Reading	Detector k	394	4,177	A few	No	1.24	Not perceptibly	30 c	2.2 c	Free
Sharpsville	.....	48	600	No	No	.05	50%	25	25	.....
Shippensburg	None	10	18	Yes	Yes	....	.....	12	4½	.....
Steelton	None	50	1,750	Yes	Yes	....	Yes	20	20	.....
Tamaqua	None	50	58	No	No	....	.....	12	4½	$3
Rhode Island:										
East Providence	None	54	1,110	Yes	Yes	....	Somewhat	..	5	.....
Providence	Hersey detector	1,045	27,305	Yes	No	....	Yes	20	10	Meter rate
Westerly	None	79	1,777	Yes	No	.22	.....	30	10	$25
Woonsocket	Hersey detector	150	3,466	No	No	.60	.....	30	10	Meter rate
South Carolina:										
Aiken	None	65	538	No	No	....	Yes	30	..	Free
Cheraw	None	108	108	Yes	No	....	.....	33⅓	8	$45 per hyd.
Clinton	None	130	410	Yes	Yes	.60	50%	30	..	$25
Florence	None	64	757	No	No	....	Yes	25	15	$40
Georgetown	None	50	300	No	No	....	33%	..	..	.....

Rock Hill	Hersey detector	125	624	No	No	....	Yes	30	14	$50
Sumter	Turbine and rotary piston	110	903	No	No	.13	Unquestionably	25	8	$35
Union	Hersey detector	60	360	Yes	No	....	.....	30	11	Meter rates
South Dakota:										
Aberdeen	None	0	0	....	....	....	.....	..	..	Free
Deadwood	None	10	65	No	No	1.25	Yes	33⅓	5	.....
Huron	By-passes	200	1,065	Yes	No	.20	.....	25	10	.....
Mitchell	None	55	580	No	No	.60	.....	17 c	8 c	.....
Rapid City	.....	25	600	No	No	.30	33%	25 c	7½ c	.....
Tennessee:										
Clarksville	None	...	250	No	No	....	Materially	30	7	$20 to $50
Humboldt	None	2	6	No	No	....	.....	30	6	.....
Paris	None	0	50	Yes	Yes	....	None	15	9	Free
Tullahoma	None	7	35	Few	No	....	.....	25	15	.....
Texas:										
Ballinger	None	50	375	No	No	.02	Yes	20	..	.....
Bay City	None	50	400	No	No	4.50	.....	50	25	.....
Brownwood	.....	120	700	No	No	....	30%	..	..	.....
Cleburne	None	400	550	50%	No	....	.....	20	..	$30
Denton	Keystone	75	700	No	No	1.00	Yes	40	25	Free
Georgetown	None	25	25	No	No	....	.....	33⅓	..	Free
Houston	.....	1,200	10,397	No	No	....	70%	15	9	.....
Longview	None	25	300	Yes	No	....	Yes	40	25	.....
Lufkin	.....	75	300	No	No	....	Yes	50	..	.....
Nacogdoches	.....	125	550	No	No	.35	.....	..	..	.....
Paris	None	225	1,650	Few	Few	....	.....	33	10	Free
Waco	None	1,200	1,400	No	Yes	....	.....	..	..	.....
Waxahachie	Worthington piston	85	1,150	Yes	Yes	....	.....	50	25	Free
Utah:										
Ephriam	None	0	0	....	....	....	.....	..	..	.....
Nephi	None	1	1	Yes	....	....	.....	..	..	.....
Salt Lake City	None	410	1,214	Few	No	.82	Yes	7	6	Free
Vermont:										
Barre	None	35	233	Some	Owners	....	Yes	16 c	8 c	.....
Burlington	.....	72	3,575	No	No	....	.....	15 c	6 c	Meter rates
Virginia:										
Buena Vista	.....	4	62	No	No	....	Yes	25	8	Free
Charlottesville	None	71	805	No	No	.27	60%	20	8	.....
Clifton Forge	None	1	15	No	No	....	.....	25	4	Free
Petersburg	None	600	5,200	No	No	....	Yes	20	7	.....
Washington:										
Bellingham	Gem, Protectus	100	654	No	No	.85	5%	20 c	3 c	.....
Pt. Townsend	None	0	33	Few	Owners	1.20	.....	60	14	5 to 10
Pullman	Keystone	570	630	Yes	Yes	.30	75%	..	33⅓	Meter rates
Seattle	Hersey, Ferguson	2,733	34,623	No	No	1.02	50%	10 c	6 c	.....
Spokane	None	3,529	11,096	Yes	No	.15	Yes	10	10	$5 to $10
Walla Walla	None	259	441	Yes	No	....	50%	20	8	Meter rates
West Virginia:										
Fairmont	.....	50	68	Yes	No	.40	.....	30	6	15c. per 1,000 gals.
Keyser	.....	7	12	No	No	....	Yes	10	10	.....
Martinsburg	None	28	40	No	No	....	Yes	20	4	Free
Sistersville	None	0	23	Yes	Yes	....	Yes	35	4	Free
Wisconsin:										
Baraboo	.....	88	391	No	No	3.00	10%	15	12	.....
Berlin	None	15	400	Yes	Yes	....	Yes	20	14	.....
Eau Claire	Hersey detector	150	1,920	No	No	....	.....	12½ c	4 c	$25 and 1c.
Ft. Atkinson	None	66	610	No	No	....	.....	8 c	3½ c	Free
Grand Rapids	.....	39	290	Yes	No	....	.....	..	..	.....
La Crosse	None	368	2,427	Yes	Yes	.75	.....	15 c	3 c	Free
Lake Geneva	.....	27	307	Some	No	....	50%	35	12	.....
Marshfield	None	35	600	No	No	.25	Yes	35	10	$100
Milwaukee	Hersey detector	2,936	59,233	Yes	Yes	.79	.....	6	6	Free
Pt. Washington	None	...	483	Yes	No	....	.....	12	4½	Free
Sparta	None	...	470	....	No	.40	30%	..	..	None
Canada:										
Brantford, Ont.	Trident, Crest	5	790	No	Yes	....	Yes	20	5	Free
Calgary, Alta	None	113	133	No	No	....	Yes	25	5½	$10
London, Ont	None	412	2,076	No	Yes	....	Yes	15 c	8 c	.....
Quebec, Que	None	5	35	No	No	....	.....	60	10	Free
St. Catherines, Ont.	None	10	133	Most	Owners	....	Yes	12 c	3 c	5 to 20
Toronto, Ont	None	210	3,512	No	No	....	.....	10	7½	.....
Winnipeg, Man	Sealed valves	3,201	27,680	No	No	.1126	Yes	23	18	.....

a—From $10.80 for 1½-in. to $64.80 for 8-in. b—City is beginning to put in and maintain meters. c—Per hundred cubic feet. d—For fire hydrants and sprinkler heads, respectively. e—Valves sealed and 25 cents charged for resealing. f—They pay $5 per annum for service maintenance. g—Allow water to be used to this amount. h—On one 4-inch service; hydrants sealed on others. i—Meters rented. j—Where no Hersey, valve with 2-inch disc meter on by-pass. k—Also check valves with metered by-pass.

NOTE—In most cities where consumers do not pay for maintaining meters, they are charged with repairs due to freezing or hot water.

TABLE NO. 6.—METERS AND RATES—PRIVATE.

City.	Kind on fire connections.	Service meters. Number added during year.	Service meters. No. now in use.	Do consumers Own meters?	Do consumers Maintain meters?	Cost per year of maintenance, etc.	Reduction in consumption due to meters.	Meter rates per 1,000 gals. Maximum.	Meter rates per 1,000 gals. Minimum.	Rates for private fire service.
California:										
San Jose	Crown, Empire, Nash	2,422	6,111	No	No	$0.49	Yes, no figures	25	5	$1 per mo. per in.
Stockton	Empire	65	625	Part	No	1.00	Stop waste	25	10	$1 per inch
Visalia	.....	....	35	No	No	....	Over 50%	25	10	None
Watsonville	None	132	150	No	No	....	Yes	20	20	.....
Connecticut:										
Litchfield	.....	0	5	No	No	....	.....	..	..	.....
Naugatuck	None	....	70	No	No	....	.....	15	10	.....
New Canaan	None	0	7	No	No	....	.....	30	30	None
Plainville	.....	17	67	No	No	....	Yes	27	6	$20 and 5c. a
Portland	None	0	4	No	No	2.50	.....	..	..	$30 per an.
Illinois:										
Carlinville	None	....	....	...	...	....	.....	..	..	.....
Effingham	None	12	130	No	No	1.25	Yes; no figures	40	15	.....
Lincoln	Trident	43	575	A few	No	....	30%	40	12	$25 to $50
Peoria	Hersey Detector	12	377	No	No	....	.....	20	6	$41.60 and 15c. a
Quincy	Hersey Detector	210	3,712	No	No	....	.....	45	6	$30 and 10c. a
Streator	None	47	4,951	No	No	....	A little	30	8	$35
Indiana:										
Greensburg	None	10	75	No	No	....	.....	35	15	None
Indianapolis	Detectors	318	3,570	No	No	....	.....	18	4½	$25 to $50
Jeffersonville	Hersey, Gem, Nash	40	135	No	No	....	Yes; no figures	32	8	.....
Linton	.....	20	86	No	No	....	.....	35	9	.....
Richmond	None	228	3,267	No	No	....	.....	25	6	None
Seymour	None	15	73	No	No	....	⅓ to ½	..	..	.....
Valparaiso	.....	75	836	Yes	Yes	....	Yes; no figures	27	9⅓	.....
Vincennes	Hersey detector, Trident compound	....	....	No	No	....	.....	25	8	$40
Kansas:										
Cherokee	None	0	4	No	No	4.30	.....	10	10	.....
Kentucky:										
Ashland	.....	....	....	...	...	....	Yes; no figures	..	..	$40
Belleville & Dayton.	Compound	221	1,288	Yes	No	....	.....	15	12	.....
Hopkinsville	National compound, Lambert, Trident	41	797	No	No	....	Yes; no figures	30	8	$10 to $60
Maysville	None	20	115	No	No	....	.....	40c	6½	$40
Middlesborough	None	77	367	No	No	.34	20%	22½	5	$40
Pineville	None	0	12	No	No	....	.....	..	..	$60 to $192
Maryland										
Hagerstown	None	12	576	No	No	....	.....	30	6½	$50
Massachusetts:										
Bridgewater	.....	....	300	No	No	....	No	25	20	.....
Hudson	.....	30	1,195	No	No	$1 or less	33%	..	..	.....
Whitinsville	None	0	12	Yes	No	....	.....	..	..	.....
Michigan										
Alma	National crown	30	450	No	No	.70	Yes; no figures	20	4	.....
Iron Mountain	Empire compound	5	678	Some	No	....	Yes	30	8	.....
Minnesota:										
Hutchinson	.....	27	175	Yes	Yes	....	Yes	..	..	.....
Mississippi:										
Bay St. Louis	None	0	0	...	...	....	.....	..	..	.....
Missouri:										
Carrollton	None	10	105	Yes	Yes	....	.....	25	11	.....
Chillicothe	None	120	720	No	No	1.00	Nearly 50%	50	20	$35
Montana:										
Livingston	None	3	53	No	No	....	Yes	40	3	None
New Hampshire:										
Berlin	None	66	187	No	No	....	Yes	40	13½	$25 Per hydrant
Walpole	.....	....	143	No	Yes	....	.....	..	..	.....
New Jersey:										
Somerville	.....	....	31	No	No	....	.....	20	10	.....
New York:										
Amityville	None	1	1	Yes	Yes	....	.....	30	30	$25
Elmira	Turbine type	343	3,902	No	No	.281	Yes	40	5	$300 for 6"
Ilion	None	0	20	No	Yes b	....	.....	40	4	None
Mt. Vernon	Hersey detector	276	5,000	No	No	....	.....	40	10	$10 i
New Rochelle	None	....	....	No	No	....	.....	30	20	.....
Seneca Falls	None	5	66	No	No	....	.....	27	13½	$20 and 10c. a
North Carolina:										
Henderson	None	100	400	No	No	....	Yes	9⅓	13½	$17.50 per nozzle
Ohio:										
Conneaut	None	62	1,000	Yes	Yes	.35	Yes; 50%	25	6	$50
Delaware	None	48	1,054	Yes	Yes	....	Yes	25	7	$40 per hydrant
Washington C. H.	None	15	Ab't 50	No	No	....	.....	25	16	$30
Pennsylvania:										
Carbondale	.....	10	60	No	No	....	Yes	20	.6	$20
Ellwood City	None	205	733	Yes	Yes	....	About 30%	.40	.4½	$40 per hydrant
Galeton	Niagara and Empire	2	10	No	Yes	2.00	Yes	.30	.30	$15.75 per hydrant
Gettysburg	None	5	75	No	No	.11	Yes	25	12	c
Hanover	Hersey detector	....	104	No	No	....	.....	30	11	$25 per hydrant d
Hazleton	.....	None	10	No	No	....	.....	25	10	.....
Indiana	None	52	740	No	No	....	Yes	50	15	$25 per hydrant
Jersey Shore	.....	3	8	...	...	....	.....	30	..	.....
Lehighton	None	None	10	No	...	2.50	.....	50	.03	$15 per hydrant
Lewistown & vicinity	None	10	36	Some	Some	....	.....	44	.04	$15 for 4" con.
McDonald	None	22	548	No	...	....	.....	60	.08	None
Minersville	None	None	38	No	No	....	Yes	27	.08	.....
Myersdale	Keystone	2	20	Some	No	....	.....	30	15	.....
Parkesburg	.....	....	30	No	No	....	Yes	30	12	.....
Sayre	Pittsburgh, Thompson & National	50	927	½ Owners	do	...	No	..	..	None

For footnotes see page 673.

TABLE NO. 6.—METERS AND RATES—PRIVATE.— (Continued.)

City.	Kind on fire connections.	Service meters. Number added during year.	Service meters. No. now in use.	Do consumers Own meters?	Do consumers Maintain meters?	Cost per year of maintenance, etc.	Reduction in consumption due to meters.	Meter rates per 1,000 gals. Maximum.	Meter rates per 1,000 gals. Minimum.	Rates for private fire service.
Shamokin	.....	....	64	No	No	....	.....	26⅔	5⅓	$20 per hydrant
Towanda	.....	....	....	No	...	3.00	.....	50	10	$25
West Newton	Hersey	25	225	No	No	1.50	Yes	50	11	.....
Wilkinsburg	.....	416	13,089	Yes	No	....	Decidedly	27	8	.....
South Carolina:										
Charleston	None	50	325	No	No	....	.....	25	7½	.....
Texas:										
Navasota	.....	350	500	No	...	....	.....	40 e	15 e	.....
San Angelo	None	60	1,535	No	No	.18	½	31	15	.....
Stamford	.....	10	360	No	No	....	.....	50	..	.....
Wisconsin:										
Ashland	Hersey detector	45	588	Some	Yes	2.00	Yes	30	.05	$50 per hydrant f
Green Bay	None	1,946	3,754	No	No	....	.....	22⅔	13½	g
Ripon	None	11	120	Some	owners do	.40	Slightly	25	10	$100 per 6" con.
Superior	Compound	659	4,685	No	No	1.00	Yes; no figures	38	7½	$40 per hydrant h
Washburn	.....	....	2	...	Yes	....	.....	..	..	.....

a—Per private fire hydrant and per sprinkler head. b—10 per cent. on cost of meter. c—2-in., $15; 3-in., $20; 4-in., $25; 6-in., $40; 8-in., $100. d—2-in., $10; 4-in., $25; 6-in., $50. e—25 cents for meter rent additional. f—$3 per 1,000 sq. ft. protected by automatic sprinkler system. g—2-in. connection, $30; 2½-in., $35; 3-in., $40; 4-in., $50; 6-in., $75. h—$10 per year for each additional hydrant. i—For the first opening, $5 per year for the next five openings, and $2.50 for all over six.

TABLE NO. 8.—TREATMENT OF WATER—PRIVATE.

City	Sand Filters Slow	Sand Filters Rapid	Sedimentation	Softening plant	Treatment for algae	Hypochlorite	Other treatment
California:							
Watsonville	.....	Yes	....	....	Yes	.....	.....
Connecticut:							
New Canaan	.....	Yes	....	....	Unneeded	.....	.....
Plainville	.....	....	....	....	Copper sulphate	.....	.....
Illinois:							
Carlinville	Yes	....	....	....	.....	.....	.....
Harvey	.....	....	....	....	.....	.....	.....
La Grange	.....	....	....	....	.....	.....	.....
Lincoln	.....	....	....	....	.....	.....	Lime in wells 4 times a year
Peoria	.....	....	....	....	Yes	.....	.....
Pontiac	.....	....	....	....	.....	.....	.....
Quincy	.....	Yes	Yes	....	Yes	Yes	.....
Streator	.....	Yes	Yes	....	.....	Yes	Sulphate of alumina
Indiana:							
Indianapolis	Yes	....	Yes	Yes	.....	Yes	.....
Richmond	.....	....	....	....	Copper sulphate	.....	.....
Seymour	.....	Yes	Yes	....	At times	At times	Alum as coagulant
Valparaiso	.....	Yes	Yes	....	Yes	Yes	.....
Vincennes	Yes	....	Yes	....	.....	Yes	Sulphate
Kentucky:							
Ashland	.....	....	Yes	....	Occasionally	Yes	Coagulates with lime and iron
Hopkinsville	.....	Yes	Yes	....	.....	.....	.....
Maysville	.....	....	Yes	Yes	.....	.....	Coagulate with lime and iron
Pineville	.....	....	....	....	.....	Yes	.....
Maryland:							
Hagerstown	.....	a	....	....	.....	.....	.....
Massachusetts:							
Whitinsville	In summer	....	....	....	.....	.....	.....
Montana:							
Livingston	Yes	Yes	....	....	.....	.....	.....
New Hampshire:							
Berlin	.....	Yes	....	....	.....	Yes	.....
New Jersey:							
Somerville	Yes	....	....	....	.....	Yes	Aluminum sulphate
New York:							
Elmira	.....	Yes	....	....	Yes	Yes	.....
Ilion	Yes	....	....	....	.....	.....	.....
Mt. Vernon	.....	Yes	Yes	....	Yes	Yes	Aluminum sulphate
New Rochelle	.....	....	....	....	Yes	Yes	.....
Seneca Falls	.....	Yes	....	....	.....	.....	.....
North Carolina:							
Henderson	.....	Yes	Yes	....	.....	.....	.....
Ohio:							
Conneaut	.....	Yes	Yes	Yes	.....	.....	Aluminum sulphate
Pennsylvania:							
Carbondale	.....	Yes	Yes	Yes	.....	.....	.....
Ellwood City	Yes	....	....	....	Yes	At times	.....
Galeton	Yes	....	....	....	.....	....	.....
Gettysburg	.....	Yes	Yes	....	Yes	Yes	.....
Hanover	Yes	....	Yes	....	Copper sulphate	Yes	.....
Hazleton	.....	....	....	....	Yes	.....	.....
Indiana	.....	Yes	Yes	....	.....	.....	Aluminum sulphate
Jersey Shore	.....	....	....	....	.....	Part	.....
McDonald	.....	....	....	....	.....	Sometimes	.....
Myersdale	.....	....	Yes	Yes	.....	.....	.....
Sayre	.....	Yes	....	....	.....	Yes	Aluminum sulphate
West Newton	.....	....	....	....	Copper sulphate	.....	.....
Wilkinsburg	.....	Yes	Yes	....	Very seldom	Yes	.....
South Carolina:							
Charleston	.....	Yes	Yes	....	Yes	.....	.....
Texas:							
San Angelo	.....	Yes	....	....	.....	.....	.....
Wisconsin:							
Ashland	Yes	....	....	....	.....	Yes	.....
Superior	Yes	....	....	....	.....	.....	Aerated

a—Rapid sand filter and hypochlorite used for auxiliary creek supply.

NOTE—Table Number 7, giving data concerning treatment of water in public plants, is crowded out by lack of space, and will be published later. It contains reports from more than 150 cities which subject their water supply to filtration or chemical treatment.

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CHANGE OF ADDRESS

Subscribers are requested to notify us of changes of address, giving both old and new addresses.

Contributions suitable for this paper either in the form of special articles or of letters discussing municipal matters, are invited and paid for. Subscribers desiring information concerning municipal matters are requested to call upon MUNICIPAL JOURNAL, which has unusual facilities for furnishing the same, and will do so gladly and without cost.

MAY 7, 1914.

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Use of Water Meters.

The past four or five years have seen a remarkable growth in the use of water meters, which would seem to forecast a day when practically all water sold in municipalities will be measured. We have not had time to analyze the figures in the tables in this issue, as many of them have been received within four or five days; but taking only 24 cities in the states of Missouri, Montana, Nebraska and New Hampshire, we find that these installed 4,675 new service meters in 1913, giving them a total of about 82,600 meters in service. As there are probably forty times this number of plants using meters, this rough calculation gives more than three million meters. Probably we would be safe in saying that the number lies between two and four millions.

Not only are services metered, but large meters are used on supply mains from reservoirs or pumps, at purification plants and wherever complete and accurate knowledge of the operation of the water works system requires a measurement of the quantity of water dealt with.

A pump may be used as a meter, its accuracy depending upon the absolute constancy of the amount delivered at each stroke and the accuracy of the determination of this amount. Unfortunately the latter determination is difficult without using a meter; and the "slip" generally increases continuously, changing the rate. In some pumps, also, the length of stroke is not always constant. Measuring by plunger displacement is much better than nothing, but cannot compare with a good meter in certain accuracy.

Water Works Records.

We again call attention to the unbusinesslike way in which too many of our water works, private as well as public, are operated. It would seem almost incredible to a business man accustomed to business methods that the superintendent of a water works plant should not know how many customers he had on his books, how many properties were connected with the system, how many services were metered, or even how many fire hydrants and stop valves there were in the system. And yet not one, but dozens, of superintendents are ignorant of one or more of these features of their plant. Given a plant concerning which the superintendent does not know the total cost to date, the amount of pipe or number of fire hydrants and valves which there are in the system, the number of service connections, or the amount of water which is being used, we cannot see how it is possible for him to make any intelligent system of rates, or even to know whether the water works is being carried on at a profit or at a loss.

As a matter of fact we know that there are many cities (and suspect that there are more) in which there are service connections of which the superintendent is totally ignorant, and through which water is being drawn without any payment by the consumer; there are stop valves, the location and even the very existence of which is unknown, and some of which may be and probably are closed; and there are even lines of pipe which have never been recorded and whose existence has been forgotten. The writer once uncovered an 8-inch main line valve which was not recorded in the water department's office, and which was leaking badly at the stuffing box, and probably had been in this condition for years.

The very fact that the mains, valves and other underground appliances are to be at once buried and out of sight is the most urgent reason why every pipe and fixture pertaining to it which is placed underground should be carefully noted and its exact position determined and recorded. Not only this, but a record should be kept of each (as by a card catalogue, for instance) and of all inspections and repairs of valves, hydrants and other appurtenances, thus giving a complete history of each in compact form. It would also seem advisable to have a map or maps on which each one of these is shown and designated by a number, this same number to be used on the card indexes and all other references to the appurtenance.

All of the details of a small plant can undoubtedly be carried in the head of an intelligent superintendent who devotes his entire time to the plant; but if the plant grows the time will come when no one head can carry all the details; and whether it grows or not, this one mental catalogue of the company's underground plant will sometime die, and if no written record is left behind his successor and the company are placed at a decided disadvantage. Moreover, a superintendent who carries in his memory the only record of these appurtenances has the company at his mercy and may almost compel them to retain his services; and no company should permit any of its employees to place it in this position, but should require that all the knowledge which they possess concerning the plant should be placed in permanent record in one form or another.

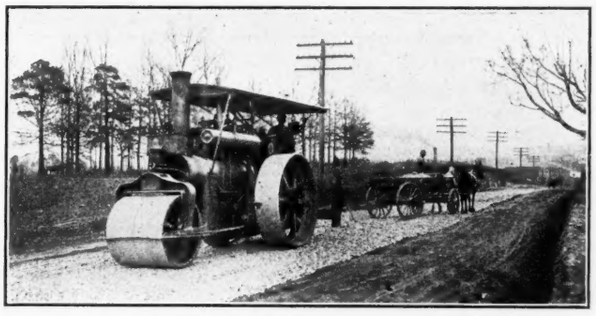
The WEEK'S NEWS

Detroit Will Build More Concrete Roads—Providence Water Project Seems Killed—Cleveland Gets Plant and Lower Rates—Marconi to Speak at N. Y. Fire Chiefs' Convention—File Commission Government Petitions in Newark—New Municipal Building in Dallas.

ROADS AND PAVEMENTS

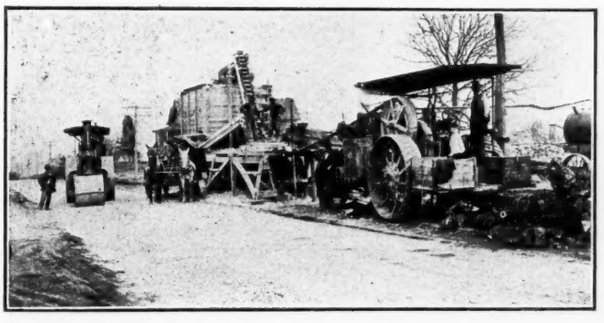
Construct Macadam Roads in Charlotte.

Charlotte, N. C.—Realizing that macadam roads are not able to withstand the great wear imposed upon them by automobiles, the Mecklenburg County authorities, who have already constructed 200 miles of macadam road, have nevertheless found it well to connect the gaps



Courtesy Charlotte (N. C.) Observer.
MACADAMIZING DOWD ROAD.

between these roads with macadam paving. One of the important sections of road thus paved is the Dowd Road, south of the city. This road leads out into Berryhill and Steele Creek Townships, two progressive and populous communities. The equipment used in constructing the road is modern and has been found very efficient. The



Courtesy Charlotte (N. C.) Observer.
CONSTRUCTION SCENE, SHOWING EQUIPMENT.

accompanying illustration shows the portable stone crusher, traction engine, the Kelly road roller made at Springfield, Ohio, and the stone distributing wagon, a product of the Climax Mfg. Co. of Marathon, N. Y. The work is in charge of Supt. J. P. Beatty.

Satisfied With Concrete Roads; to Build More.

Detroit, Mich.—Building of concrete roads will be in full swing again in Wayne County by May 10, when 500 men will be at work grading, rolling and surfacing the main roads outside of Detroit, according to information received. Bonds to the value of $334,000 are to be sold before summer to provide the additional funds required. There are now more than eighty miles of concrete roads in the county, and the commissioners propose to spend nearly $500,000 this year in extending the system. The first of these roads was built in 1909, and, although the method of construction was inferior to the present methods and this road carries an average traffic of more than 2,000 vehicles per day, representatives of the United States Office of Public Roads and the Michigan State Highway Department say that there has not been a quarter of an inch of surface wear since it was built. The average cost of the concrete roads has been about $1.60 a square yard. Some have been built for $1.04 a square yard, complete. The chairman of the county board, in a report read at the National Conference on Concrete Road Building at Chicago, presented a detailed statement which showed an average cost of $28.50 a mile for repairs, not including cleaning ditches, reshaping sides and shoulders, and cutting weeds. Not a single section of road of this construction has had to be replaced.

Steam Rollers and Dump Wagons Eliminate Teams.

La Porte, Ind.—By the use of large dump wagons to be drawn in trains of from four to six by steam rollers, the county commissioners believe they are going to get around the 35-cents per hour team law which was passd by the last legislature. The wagons, 24 in number, have been ordered and will be hauled by steam rollers, of which the county owns two. If the experiment is successful the county will find it unnecessary to hire teams to be used in road repair work and besides will save money. The law, which made the maximum price that could be paid by the county for team, 35 cents per hour, was a great stumbling block to the commissioners in this county when they found, as expected, that the lowest bids for teams were 45 cents per hour. The wagons ordered are known as Troy dump wagons and will hold 3½ yards of stone. It is said that six of them can be hauled by one of the county's steam rollers and make as many trips per day as can be made by teams.

County Has 153 Miles Improved Roads.

Atlantic City, N. J.—According to figures which have been prepared by County Engineer A. H. Nelson, 153.86 miles of country roads have been improved during the last eighteen years by the Board of Freeholders, making the mileage of improved roads in Atlantic County compare favorably with any other county in the State. While nearly all the roads have been surfaced with gravel, yet three of them have been finished in other materials. The Ocean Boulevard is surfaced with Amesite for 9¼ miles, and gravel the remainder; the Meadow Boulevard with Warrenite for 6 miles and gravel the rest, and the Longport Drive with macadam for 1.54 miles and bithulithic construction 1.46 miles.

Statistics Show Necessity of Hard Roads in Illinois.

Lewistown, Ill.—At a recent meeting held in Lewistown to explain the workings of the Tice road law S. E. Bradt, secretary of the state highway commission, stated that the hard roads are bound to come and gave statistics to prove that the automobile traffic will force it. In 1905, statistics show, 95 per cent. of the traffic consisted of conveyances drawn by horses and five per cent. by automobiles. In 1910 there was 50 per cent. by each and in 1911, the date upon which the last estimate was made, the automobile was 60 per cent. and the travel by horses 40 per cent.

Claims to Have Established New Record in Paving.

Jacksonville, Fla.—In closing up the work on Laura street a record run was made by the Atlantic Bitulithic company. The account is given in the local paper as follows: Thursday all of the necessary grading was removed and every other preparation made. Friday the five-inch concrete base for the modern asphaltic concrete pavement was laid. This work was completed by Saturday

noon. On Monday the vitrified gutters, providing for the best of drainage were placed adjacent to the curbs. Then on Thursday morning the concrete base having been given the necessary time to set the asphaltic concrete wearing surface, amounting to 2,450 square yards, was added, the work being completed this same day.

Road Work Progressing.

Warsaw, N. C.—J. W. Best, superintendent of the road construction work being done in the southern part of Duplin county, who was at Warsaw, says this work is progressing rapidly. About a dozen miles of sand-clay road has been built from the proceeds of the $30,000 bond issue voted by the citizens of Wallace sometime ago, and about 50 miles of these roads will be completed within two years.

Purchase Additional Steam Roller.

Woonsocket, R. I.—The aldermanic committee on streets and bridges at a recent meeting has purchased a new Buffalo-Pitts steam roller for use in the highway department. This is a duplicate of the one that was purchased last year. The unusually large amount of highway work to be done this year made it imperative that a new machine be purchased.

Will Oil Streets.

Hillsboro, Ore.—The city authorities are having some of the unpaved streets graded and rolled with a steam roller, preparatory to trying oil on them. The county has purchased an oiler for use on the county roads, and it will probably be tested in the city soon. No hard-surface paving work has been projected for this year.

Springfield Active on "Good Road" Day.

Springfield, Ill.—On "Good Road" Day well known men joined with farmers here "to pull Illinois out of the mud." The section of the Lincoln Highway around Aurora was the scene of activity of a party comprised of Col. C. F. Mills, former State Senator Rees and Mr. Baker of the Baker Construction Co., and Rev. D. C. MacLeod, all of whom are shown in the illustration from left to right. The machine used is the Straits Traction Gasoline Road Engine, drawing Baker's adjustable steel road drags.

Courtesy Illinois State Register.
"GOOD ROADS" ENTHUSIASTS IN SPRINGFIELD.

WATER SUPPLY

Providence Water Project Is Killed.

Providence, R. I.—By a vote of 44 to 33 the House of Representatives has refused to receive a report from the judiciary committee favoring the passage of the so-called Providence Water Supply Act. The bill was not allowed to be placed on the calendar. The result of the vote is that the act is not before the House and will have to be reported again by the judiciary committee. In the opinion of many members of the House, however, including members of the judiciary committee, the vote actually means that the Providence Supply act is killed.

Oakland to Vote on Water Plant Purchase.

Oakland, Cal.—Municipal ownership of public utilities is gaining a strong foothold in Oakland. The latest plan, which has been endorsed by the mayors of all the East Bay cities, is the acquisition of the People's Water Company, now offered for sale at a price to be fixed by the State Railroad Commission. Oakland already owns a short municipal railroad, one of the best systems of wharves in the country, many hundreds of acres of land along the water front for industrial sites, and a high pressure water system. An election will be called shortly to allow Oakland citizens to decide whether or not they wish to buy the water plant. The water company has offered a forty-five day option on the plant, and if the citizens vote in favor of its purchase this option will be extended to give the railroad commission an opportunity of appraising the property and fixing the price.

Small Town Has Water Supply.

Sharon Center, O.—Sharon Center, Medina county, enjoys the probable distinction of being the smallest town in the state having a system of water works. From the side of a hill well above the general level of the village, a strong spring flows from the sandstone rock. The stream from this spring fills a four-inch pipe, and the flows does not vary perceptibly with the change of seasons. A large cement tank holding 900 barrels has been built farther up on the summit of the hill. A hydraulic ram has been set a little below the outlet of the spring. From this, water is forced into the tank. A service pipe leads from the tank to the town, almost a mile away. This water, coming as it does from the standstone rock, is pure and has the added advantage of being soft.

Strengthen Reservoirs.

Colorado Springs, Colo.—Dams at the various reservoirs in the city's mountain water system are being strengthened and placed in first-class condition to hold the enormous amount of water which will soon fill the lakes. Snow already is beginning to melt, and as the fall in the mountains was heavier this year than for some time it is quite likely that the water supply during the summer will be more than sufficient. There is but a slight possibility that any of the dams on the system will give way, in the opinion of water department officials. However, every precaution will be taken. The water department soon will take action on the matter of sprinkling hours. While the supply will be large enough to accommodate everyone at the same time, the mains are not of sufficient size to insure pressure in all parts of the city.

Prepare to Obtain Water Supply from Spring.

Winner, S. D.—Material for casing the springs seven miles south of Winner has been received and it is now planned by Mayor Barnum and members of the water committee to rush the work so that water can be piped to the city this summer. They propose to sink ten twelve-inch casings with sieve attachment that will completely separate the quicksand from the water flow before it reaches the main. As soon as the casings and sieves are in place the large pump which has been in use in the old wells will be used for the final test in forcing the water from the quicksand beds and ascertaining the capacity of the springs. Under the direction of the Northwestern Railroad Company a test has been made by chemists who pronounced the water equal if not better for engine and domestic purposes, than that of Lake Michigan.

Municipal Plant May Solve Pure Water Problem.

Defiance, O.—City Solicitor Shaw has submitted a report to the City Council in reference to the procedure to be taken

to secure a municipal water works. There are two propositions before the Council, either to construct an entirely new plant or to purchase the existing water works. The Council must decide which proposition is to be placed before the people. The financial condition of Defiance is favorable to either proposition. At the request of the local Board of Health an examination was made by the State Board to determine the purity of the water supplied by the company. The sample examined was declared impure and cause must be shown on May 5th why the company cannot construct a filtration or purification plant by October, 1915.

Water Wasted by Municipal Departments.

Jersey City, N. J.—Directors of Streets and Public Improvements James J. Ferris has reported to the Board of Commissioners the result of his investigations into the use of water by the various municipal departments. He said that he had ascertained that in public building and public places, including parks and schools, water aggregating in cost $14,927.47 is used while in other buildings, such as hospitals, parochial schools and churches, $2,591.50 worth of water is used. He asserted that this showed great waste as the amount was wholly unwarranted by the necessity of the users, and he warned the commissioners to take action to stop the waste.

May Regulate Massachusetts Water Companies.

Boston, Mass.—The water power and water supply companies are believed to have accepted the terms of legislation recommended by Governor Walsh. By the terms of this bill the commission will have authority over these companies similar to that which they now have over the lighting companies.

Injunction Stops City's Water Extension.

Bethlehem, Pa.—Judge Scott of the Northampton County Court has granted a temporary injunction to the Bethlehem city water company restraining the Borough of Bethlehem from extending its water mains into the company's territory on the west side. A decision of the Supreme Court two years ago gave the borough permission to extend its mains.

To Plant 3,000 White Pines Around Reservoirs.

Holyoke, Mass.—Three thousand five-year-old white pine trees will be transplanted to the property of the water department surrounding the reservoirs, this decision having been arrived at by the board of water commissioners. Although not included in the plan these trees will form the basis for the development of a nursery later on.

Vote for Municipal Water Plant.

Covina, Cal.—Municipal ownership has scored a victory at the special election to decide upon establishing a municipal water plant. The vote stood 426 for and 66 against the proposition.

SEWERAGE AND SANITATION

Cleaning of Sewers Develops Unusual Conditions.

Lewistown, Pa.—Street Commissioner A. A. Aurand and three borough laborers have been at work the past week flushing and cleaning the sewerage system of Lewistown. It is six months since the sewers were washed and large quantities of dirt were removed from them. The sewer line from Fountain Square to Logan street on Chestnut street is entirely clogged and all efforts to force water through it were futile. The sewer on East Fourth street from North Brown street to North Dorcas street extended is also closed at some unknown point. In some unknown manner the water forced into this sewer found some course of escape into an underground passageway. The water from the fire hose turned into the Fourth street sewer did not flow from one end to the other terminus of the sewer but disappeared somewhere under the ground, indicating that the sewer is broken and that an underground passage way has been formed outside the sewer.

Sewer Work Completed.

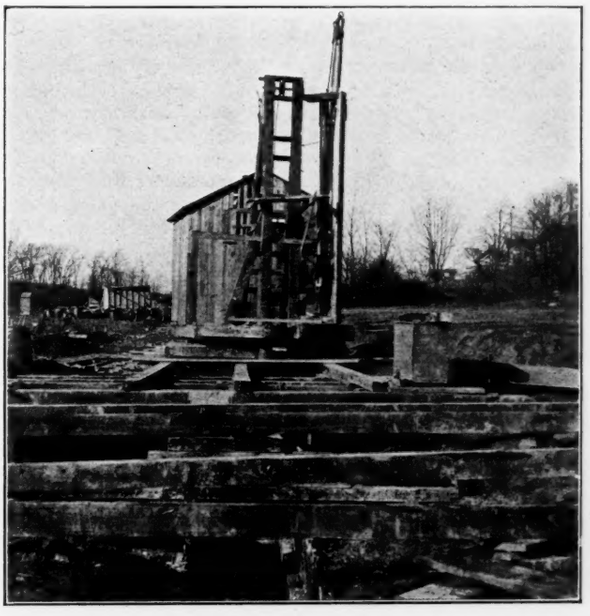
Kalamazoo, Mich.—Work on the Pitcher Street sewer begun during February in order that many unemployed men of this city might be afforded the opportunity of earning wages, has been finished under the direction of City Engineer Andrew Lenderink. With the completion of the sewer, which measures 2,000 feet, work will be undertaken immediately on the proposed sewer from the Kalamazoo River to Pitcher Street, the agreement having been reached by city officials with officers of the C. K. & S. Railway Company. The latter work will comprise the laying of 2,000 feet of pipe.

Unusual Cause of Sewer Cave-in.

Haverhill, Mass.—There was a serious cave-in on Race street about half way from Haverhill to Keeley street, which Alderman Wood discovered recently on his tour of inspection of streets where there was a hole about six feet square. Alderman Wood says that this cave-in was caused by rats which burrow in from the sewer, undermining the foundations. He says that rats cause considerable trouble of this kind and that there have been instances where it has been necessary to use a number car loads of dirt to fill up holes caused by their work.

Strike Water and Quicksand in Constructing Sewer.

Middletown, N. Y.—In constructing the new sewer, which was begun last June, great difficulty was encountered in the marshy land through which the sewer goes. Water and quicksand were encountered and many cave-ins resulted in an almost complete abandonment of the work. At one place the cave-in was almost 150 feet across and the ditch at this point is about 14.5 feet deep. Much time was lost in placing piles for the protection of the workers, wooden



Courtesy Middletown (N. Y.) Times-Press.
PILE DRIVER USED IN SEWER WORK.

planks being used at first. These were soon found impracticable, however, against the great weight of the earth, which continued sliding, and sheet steel piling was ordered, which is now in use. To put this in place it was necessary to rig a hoisting engine, and Commissioner Korschen did this with but small expense to the city. A small engine was procured, and this was rigged up into a pile driver and drawer, a hoisting machine, and was also connected with a boom and derrick.

STREET LIGHTING AND POWER

Cleveland's New Plant to Give Cheaper Light.

Cleveland, Ohio—Cleveland, which has 3-cent carfares, will now furnish electric light at 3 cents per kilowatt with the opening by Mayor Newton T. Baker of the new municipal lighting plant. The project, which was conceived by the late Mayor Tom L. Johnson and completed by his successors, was started in October, 1911. The plant so far has cost $900,000. It has 5,000 contracts. A bond issue of $700,000 was recently added to the original $2,000-

000 bond issue to provide for extension of the system through the entire city and suburbs. The maximum rate is 3 cents per kilowatt and the minimum 1 cent. Private companies charge 10 cents a kilowatt. F. W. Ballard, consulting engineer, says he expects the plant to pay for itself within the next year. According to estimates the current will cost one-half cent per kilowatt at the switchboard.

City Plant Gets 412 New Patrons in 4 Months.

Richmond, Ind.—From January 5 up to April 24 the Richmond municipal plant has added 412 new patrons to its extensive list, according to Superintendent Kleinknecht. "In January we made 112 connections, 68 in February, 104 in March, and so far this month, 128," the plant Superintendent stated. "The number of connections made so far this month has broken all records for the plant and I do not expect it to be equaled again. At the present time we have ninety per cent. of the Main Street business. Last year we had less than sixty per cent. of this business."

Mr. Kleinknecht states that the plant receipts for April will be about $9,500, or an increase of $2,000 over April, 1913. "Of course the city," he continued, "is now paying for its street and public building lighting, but at the same time the commercial rate is 16 2-3 per cent. lower than it was in April last year, so it can be seen what a thriving business the plant is now doing."

Abandon Municipal Light Plant.

Lapeer, Mich.—The village council of South Branch has voted almost unanimously to withdraw the order for a special election on the question of bonding the village for $7,000 to maintain and repair the municipal lighting plant now in service, thereby making it necessary to either sell their plant to a private corporation or seek surrent elsewhere. This latter prospect is very favorable to the citizens of North Branch, who, hampered by enormous expenses, poor service and many other inadequacies, welcome anything in the power line that would better the present situation. North Branch balloted strongly in favor of municipal lights at the last election, but after a year's trial of public lighting is decidedly dissatisfied.

Competition May Lower Rates.

St. Crois, Me.—The territory supplied by the St. Crois Gas and Electric Light Company, which includes besides Calais, St. Stephen and Milltown, N. B., is about to be invaded by the Calais Street Railroad Company. That concern has a modernly equipped power plant at Milltown, which only awaits the completion of a new water wheel to be swung into full operation. It is generally believed that the resulting competition will do much to increase the efficiency of the present service and to lower the rates now in force.

Builds Municipal Plant and "White Way."

Camden, S. C.—After the completion of its new municipal lighting plant, Camden will become a well lighted town for its "white way" is already in the course of construction. The lighting system will be made up of Doric standards, each bearing five electric lamps of 100-candle power. The cluster lights will be used only in the business section, and in residential streets 100-candle power lamps will be placed at intervals of two hundred feet.

Nitrogen Lights in Springfield, Ill.

Springfield, Ill.—Springfield is one of the first towns in the United States to obtain some of the new nitrogen tungsten filament lamps, the very latest thing in electrical illumination devices. It is a tungsten filament and resembles exactly the regular tungsten lamp, but inside the globe in the 1,000 watt bulb is injected an atmosphere of nitrogen gas.

FIRE AND POLICE

Marconi to Lecture Before Fire Chiefs.

Schenectady, N. Y.—Signor Marconi, inventor of the wireless telegraph, will be here for the State Fire Chief's convention to be held in this city in June. The date for the convention depends upon the time that the inventor can come here, but it is hoped that the days will be June 23 and 24. Sig. Marconi has promised to come and it is expected that he will soon settle the exact time. He will lecture before the chiefs on all of his latest inventions and demonstrate some of them. In particular he will explain a new wireless fire alarm system which is expected to do away in time with the present systems. A wireless system between the fire department and the fire boats in New York City is now in use and it is one of Marconi's inventions and is proving a great success.

Citizens to Co-operate With Officials for Fire Prevention.

Portland, Ore.—That an advisory board of citizens be authorized by the Council to assist the Fire Bureau to enforce fire regulations, was the request made on Mayor Albee recently by the fire prevention committee of the Oregon Civic League, consisting of A. M. Churchill and L. B. Smith. At the conference were Fire Chief Dowell and Battalion Chief Stevens. Hazardous conditions in the city were pointed out by the committeemen, with the statement that under present conditions the city was not in a position to eliminate them. It was suggested that new ordinances be adopted curing the defects in the present ordinances providing for the elimination of hazardous conditions, and that the proposed advisory board be given authority to act in conjunction with the Fire Bureau in the elimination of hazards when they are discovered by the firemen on their inspections.

Fire Underwriters Would Improve Fire Conditions in Lowell.

Lowell, Mass.—A committee of four engineers of the Board of Fire Underwriters are engaged in an investigation for the purpose of bringing about conditions which will result in a reduction of local fire insurance rates. They are T. C. B. Snel, Charles R. Barker, F. W. Smyser and P. C. Charnock, all of New York. Their mode of procedure is to thoroughly inspect the structural conditions and fire-fighting facilities of the city, each member of the committee devoting himself to a particular part of the work. The experts have nothing to do with the making or changing of rates and their primary object is to make public whatever information they get on the matter of fire prevention, through an accurate knowledge of conditions, and to make recommendations as to what is necessary to bring conditions to a reasonable standard.

Boston to Install High Pressure Fire System.

Boston, Mass.—Four miles of streets in the business section will be torn up this summer for the laying of pipes for the high pressure fire system. It will be a work that will cause the greatest barrier to traffic that the city has ever experienced. This will be the first visible step in installing the protection long demanded by the business interests and whch was authorized by the Legislature of 1911. For three years the Public Works Department has been making the plans for fourteen miles of piping and four hundred hydrants. All plans are now completed.

Fire Alarm Bell Installed.

Cawker City, Kan.—The new fire bell has been placed in position on the water tower. The bell, which weighs 550 pounds, is located 66 feet above the ground, and is worked by a couple of wires to which are attached hand rings for operating purposes. It is expected that a system of ward signals will be adopted which will help people to locate the fire. For instance the bell will give a series of rings, then pause and mark the ward, then ring rapidly for a space of time, with another pause for ward signal.

Fire Chief Killed in Auto Crash.

Jersey City, N. J.—While hurrying in his automobile to a slight fire at 20 Morris Avenue at 2.45 o'clock last Sunday morning, Assistant Chief Hudson Lovell of the Jersey City Fire Department was hurled fifty feet when his car hit engine No. 3 at the junction of Newark Avenue, Warren and Montgomery Streets. His skull was fractured and he died three hours later at St. Francis' Hospital.

Fire Hydrants Being Flushed.

Altoona, Pa.—Employes of the water bureau have been engaged in the semi-annual inspection and flushing of the fire hydrants in the city, of which there are now 814.

Those in the outskirts which are not often used are flushed more frequently, as they are likely to become filled with stagnant water and become corroded. Those that are used are also examined after the fires. The 814 hydrants in the city represent an investment of about $45,000 by the city.

MOTOR VEHICLES

Inspects Fire Apparatus at Factory.

Williamsport, Pa.—Mayor Samuel Stabler, John W. Miles, chief of the fire department, and Commissioners Charles E. Cole, Perry Harmon, Harry Meyer and James A. L. Minor made an inspection trip recently to the factory of the American La France Co., Elmira, N. Y., for the purpose of looking over some of that company's apparatus. The result of the inspection is that Commissioner Perry Harmon, Superintendent of Public Safety, expects to present an ordinance providing for the purchase of one of the most modern pieces of motor driven-fire-fighting apparatus. The proposed car will contain an engine, plenty of hose, a chemical and ladders and will cost approximately $9,000.

Report Finds Motor Apparatus Superior.

Hartford, Conn.—In a report recently issued by the fire board for the past year attention has been called to the superiority of motor-drawn fire apparatus. In part its report says: "The various pieces of automobile apparatus continue to give good service and their prompt response has been responsible for keeping down the loss at many fires. There have been repeated instances where horse-drawn apparatus of the nearest company has been outstripped and fires handled by automobile equipment from more distant stations. The only piece of automobile apparatus put in commission during the year is Tractor B, which was placed on engine No. 1, January 25, 1914."

Motor-Drawn Fire Apparatus Expected.

Red Bank, N. Y.—The new triple combination American-LaFrance automobile apparatus is likely to arrive at Red Bank within the next few days. The new home of Relief Engine company, which adjoins the Borough hall, is rapidly nearing completion, and when the truck arrives it will be housed there. Upon the arrival of the new truck Red Bank will have three pieces of automobile apparatus, the hose truck of Liberty Hose company, the triple combination apparatus of Independent fire company, and the triple combination apparatus for Relief.

GOVERNMENT AND FINANCE

Municipal Home Rule Upheld.

Austin, Tex.—An important ruling has been given by the Attorney General to the effect that "the Legislature has no authority to grant or amend, by special law, a charter for any city or town." This ruling is handed down in pursuance of the amendment to the Constitution, commonly known as the "home rule amendment," which gives cities and towns of 5,000 inhabitants the right to amend and make their own charters. This amendment was adopted in the November election of 1912. In January last the Legislature passed a special act amending the Denison City charter by authorizing the levy of bonds up to 10 per cent. of the taxable values. The Attorney General holds this act in violation of the home rule amendment and invalid, as the Legislature was not authorized to amend the Denison charter.

Commission Government Petitions to Be Filed.

Newark, N. J.—With more than the required number of names on petitions already received, the Commission Goverment League, according to statements made at the headquarters in the Kinney building, is prepared to file the list with City Clerk Connelly at any time. Before doing so, however, it is intended to round up all the petitions still in circulation. On these there are many names, and it is anticipated that when the papers are presented there will be more than 1,000 extra names of voters. If the petitions are filed soon, the referendum will be held the third Tuesday in May. And if the new form be adopted, the election for commissioners would be held on June 19.

STREET CLEANING AND REFUSE DISPOSAL

Mayor to Reduce Expenses by Modern Equipment.

Lansing, Mich.—Economy is to be the keynote of Mayor Reutter's administration for the next two years. The mayor plans to save several thousand dollars in the department of public works alone. He thinks the $93 per day which the city is spending on the streets is entirely too much. The city has 34 street sweepers, three men and teams and two flushers at work now. This costs the city $2 for each sweeper, and $5 per day for each team. The mayor plans to purchase a motor truck for the department and have a box placed on it that can be dumped. He figures that the machine and two men will handle the collection of sweepings that now takes three teams and men and costs the city $15 per day. A similar machine is used in Detroit. The mayor also plans to flush some of the new asphalt pavements instead of continually sweeping them as at present.

Commissioner Completes Street Department Report.

Trenton, N. J.—Commissioner Fell has just completed an exhaustive report of the department of streets and public improvements for the year. The appropriations amounted to $115,179.20. The cleaning of paved streets cost the city $47,708.95, while for the cleaning and filling of dirt streets $6,379.74 was expended. The cleaning of the macadam streets cost $7,532.35. For repairs to paved streets $12,-354.28 was expended. For the sale of materials, including old wood, bricks, etc., $192.63 was received. An inventory of the property in the department totals $6,133.91.

Clean-Up Movement Leads to Effective Ordinance.

St. Paul, Minn.—St. Paul's clean-up movement has crystalized into an ordinance making it unlawful for any person to deposit on any lot or tract of land within the city or to permit to remain upon any lot or tract of land owned or controlled by him any ashes, tin cans, waste paper or substance or material injurious to the health or comfort of the community. The measure was before the Board of Aldermen and was referred to the committee on streets.

Council Buys Street Sprinkler.

Tremont, Neb.—Councilman F. M. Thompson, chairman of the street and sidewalk committee, has closed a deal for the purchase of a street sprinkler. The wagon is of the latest approved style with a 750 gallon capacity and a tank construction of steel. The deal was negotiated by H. M. Kokzer, agent for the Austen-Western Road Machinery Mfg. Co.

MISCELLANEOUS

Mayor Advocates Municipal Market.

Bridgeport, Conn.—"My inquiry showed me that the Albany, N. Y., municipal market was a good thing and I think the people here will want to try it out after they are fully informed as to its workings," said Mayor Clifford B. Wilson at the city hall, speaking upon his trip to Albany to look into the workings of the public market there. Mayor Wilson is frank enough to say that while he derived much information from his visit he will make known his recommendations based on this information at the next meeting of the Common Council probably in the form of a special message accompanying a resolution to carry the same into effect. His visit to Albany was made as a private citizen and without people there knowing or suspecting who he was.

Will Increase Playgrounds for the Summer.

Indianapolis, Ind.—During the summer months every public school yard and public park in Indianapolis will belong to the children of the city. The children will have just twice as much room in which to play this summer as they had last year. The arrangements for the increased play room for children's outdoor sports and recreation were made after numerous conferences between members of the city health board, the public school commissioners and the park commissioners. The children will be taught to play scientifically, and it is likely that an expert will be employed to come from one of the largest cities in the

country to give the boys and girls instructions in forms of play that will be most beneficial to them and which will give them the largest possible enjoyment in making use of the public playgrounds.

Signs and Other Projections Restricted.

Boston, Mass.—Rules to govern projections over public highways, with the aim of correcting abuses long suffered by the Boston public, have been issued by the Board of Street Commissioners under authority of the Acts of 1913, which left it to local authorities to determine just what was best for the city's needs. These regulations affect signs, advertising devices, clocks, marquees, awnings and all other projections from buildings, one of the most important being the stipulation that all existing posts supporting clocks or advertising devices and all private lamp-posts in the sidewalks must be removed before June 1, 1915.

Town to Try Public Market.

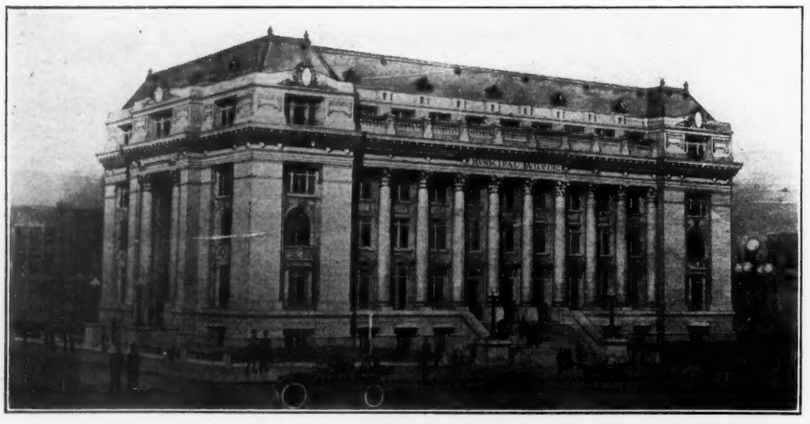
Long Branch, N. J.—Monmouth County farmers are beginning to take an interest in the proposed public market to be established in this city. Conditions being favorable the market will open early in June. This, however, depends entirely upon the farm products being ready for disposal. The site on Broadway, adjoining the Broadway Theatre Building, is so centrally located that the market should meet with immediate approval. There will be no building erected at the time as Commissioner Flock is desirous of trying out the experiment before recommending any additional expense. The rental of the grounds will be the only cost to the city for the first year.

To Purify Floating Baths.

New York, N. Y.—As a means of purifying the water in the floating baths along the shores of Manhattan and in New York Bay above the Narrows, the Board of Health has prescribed the use of ultra-violet rays, along with filtration and hypochloride treatment. These remedies for the alleged unhealthy conditions obtaining in the floating baths are prescribed in an amendment to the Sanitary Code just adopted by the Board of Health. The Board of Estimate is expected shortly to make an emergency appropriation whereby the city-owned baths along the waterfront will be brought into compliance with the new regulations, and the baths owned by individuals or companies will have to go to the expense of making similar provisions if they intend to continue in business.

Dallas Will Have Modern Municipal Building.

Dallas, Tex.—The new municipal building of the city of Dallas is nearing completion and will be ready for occupancy in a few months. It will house all of the city departments and in addition will have a modern emergency hospital in the basement and public rest rooms for both men and women. The building is said to be a radical departure in architectural design from the usual type of public buildings in the South;; it is constructed along simple but dignified lines. The structure will be of steel construction covered with blue Bedford stone, the five stories, basement and sub-basement will be a home worthy of the city of the hour, as Dallas people like to call their town. Ventilating and heating systems are being installed together with vacuum cleaners. The building, without furnishings, will cost about $550,000. C .D. Hill and Company are the architects. The structure was started by the Fred A. Jones Building Company, which failed just as the steel was up, and it is being finished within the estimates by the city under the supervision of the architects.



NEW MUNICIPAL BUILDING IN DALLAS.

Want Municipal Saloon.

St. Paul, Neb.—Leading citizens have called a mass meeting to discuss whether to establish municipal saloons instead of the regular saloons conducted by individuals. Since the action of the council in raising the license to $2,500 a year, it is thought that there will be only one saloon in town. A good many voters believe the city might as well run the saloon and get whatever profit there may be in the business.

City to Oil Stagnant Streams.

Philadelphia, Pa.—Russell Barrett, of the bureau of sanitation, has announced that the city will oil its stagnant streams and pools this summer, to help extinguish the mosquitoes.

Wisconsin Plans Co-Operative City.

Madison, Wis.—Wisconsin may be the first state in the Union to boast of a co-operative city. At least Wisconsin will contain the first municipality of this kind in the United States if the efforts and plans of the American Society of Equity to establish the city "Co-operator" in the Four Lakes' region, near Madison, do not go amiss. To be a member of the community of "Co-operator," it will cost 10 cents a week. The first plan of the American Society of Equity is the formation of a strictly co-operative organization.

BOOK REVIEWS

MODERN CITY PLANNING AND MAINTENANCE.—By Frank Koester. 329 pp; illustrated. McBride, Nast & Co., $6.00 net.

This beautifully gotten-up volume contains the exhaustive research and keen personal observation of many years. It deals interestingly with an analysis of the principles involved in city planning and gives detailed expositions of the best examples in Europe and in this country. European cities have for years developed systems of planning and these have one by one been adopted by American municipalities. Mr. Koester, by studying European methods, forecasts developments that will certainly be taken up here and in this way he has produced a work that should be of undoubted help to mayors, city councils, city engineers, town-planning committees and others interested in these important problems. Among the principal subjects treated are those of zone system developments for building heights, block plans and traffic regulations, the problems of harbor traffic, practical methods for minimizing street excavation—the prevailing ceaselessness of which is becoming a public nuisance which could easily have been avoided by scientific underground planning in the beginning. Illumination of streets by modern high-power units, telegraph signalling for police and fire departments; electric machinery for street cleaning and other municipal uses; the construction and operation of municipal abbattoirs and ice plants are discussed very carefully. The possibilities of district heating by means of wasted steam from municipal plants are studied and, somewhat outside the field of city planning, the author proposes the question of communal industries. Garden city development and housing problems are especially adequately treated. All the features are fully illustrated with excellent photographs and diagrams. Besides being a practical guide to the subject and very interesting to general reading, it will certainly become one of the standard reference works on city planning.

LEGAL NEWS

A Summary and Notes of Recent Decisions—Rulings of Interest to Municipalities

Failure to Supply Water—Liability.

Stansbury v. City of Richmond.—After a water main had been extended by the city to annexed territory, the board of health in December, 1911, notified plaintiff to connect his premises with it, which he did in January, 1912, and it appeared, after trial, that the quantity of water on the second floor of plaintiff's house was not sufficient to flush his closets, and the supply was so diminished by other buildings being connected with the main that after about a month plaintiff had no water at all for his bathroom, which facts plaintiff reported to the authorities and suggested that his premises be connected with a standpipe intended to supply an adjoining district, which was refused on the ground that such diversion would render the supply of the persons in that district inadequate. A few days after July 18, 1912, plaintiff and others signed a petition requesting action by the city to remedy the defect in their water supply, and the authorities immediately directed that the main be connected with another pipe, which was done four days thereafter, and which gave plaintiff sufficient water. Held, that the city was not liable in damages for the insufficiency of plaintiff's water supply when the main was first connected with his property, in view of its subsequent action in making an adequate supply available.

The adoption of a plan for supplying a part of a city with water involves the exercise of a delegated governmental power, so that the city is not liable in damages for an error of judgment as to the adequacy of the system as originally installed, though it may subsequently become liable after it is clearly demonstrated by experience that the system is inadequate or defective.

A city is liable for the negligent acts and omissions of its officers with respect to the performance of ministerial corporate duties imposed upon it by law.

Where water fixtures, installed by plaintiff in his house when the city water system was extended to his part of the city, have always been in his possession, and he had an adequate supply of water from the city waterworks when judgment was rendered in his action against the city for damages for inadequate supply, plaintiff cannot claim that he is deprived of his property without due process of law and denied the equal protection of the law by the judgment for the city; plaintiff not being entitled to maintain the action for damages.—Supreme Court of Appeals of Virginia, 81 S. E. R., 26.

Waterworks Bonds—Purpose of Issuance.

Chapin et al. v. Town of Lincoln et al.—Section 1907, providing that the town of Lincoln may issue bonds for the extension of its waterworks, did not authorize the town to issue bonds to reimburse it for extensions already paid for by taxation, so as to keep the waterworks' finances separate, the town being a single municipal entity, of which one department could not become the debtor.—Supreme Judicial Court of Massachusetts, 104 N. E. R., 745.

Recovery of Judgment.

City of Harper, Kan., v. Daniels.—One recovering judgment against a city on city warrants payable from the general revenue fund had a right to demand that a tax should be levied each year until his judgment was paid to the full amount authorized by statute for ordinary city expenses, and this right could be enforced by mandamus.—United States Circuit Court of Appeals, 211 F. R., 57.

Discharge of Sewage—Riparian Owners.

Feudl v. City of New Britain.—Where the charter of a city gave it the right to take by condemnation proceedings any such rights, etc., in land and water courses as were necessary for the disposition of its sewage, the city could not defend an action by a lower riparian owner for flooding his land on the ground that it was acting with a governmental capacity.—Supreme Court of Errors of Connecticut, 90 A. R., 35.

Personal Injuries—Measure of Damages.

Brown v. Mayor and Council of City of Wilmington.—In an action for personal injuries, the damages should be such as will reasonably compensate plaintiff for his proven expenditures for medical services, and for the injuries he has sustained and proved, including therein his loss of time and wages, his pain and suffering in the past, and such as may come to him in the future, and for any permanent injuries, and for such sum as will cover his pecuniary loss on account of any impaired ability to earn a living in the future as a result of the accident.—Superior Court of Delaware, 90 A. R., 45.

Taxation—Adjustment—Confirmation of Report.

Erie Elevator Co. et al. v. Mayor and Aldermen of Jersey City et al.—The circuit court's confirmation of a commissioner's report in a tax adjustment proceeding, although judicial in character, need not be put in the form of an order or entered in the minutes, as is required in proceedings generally by Supreme Court rule 40, but may be indorsed upon the report which may then be filed in a public office as notice of confirmation, and, where the duty, if any, rested upon a city through its counsel to have the rule entered in the minutes, it could not, after having accepted the award of the report, object that it was not entered especially in view of the uniform practice of filing confirmation orders, but not entering them in the minutes.—Court of Chancery of New Jersey, 90 A. R., 8.

Inequality in Sidewalks.

Goodwyn v. City of Shreveport.—In a city requiring property owners to provide a sidewalk in front of their premises at their sole expense, a difference in level ranging from 2 to 2½ inches, but which, by the accumulation of dirt on the lower sidewalk, had been reduced to an average of 1½ inches, and where the higher sidewalk did not end abruptly, but began 1½ inches from the dividing line, and sloped at an angle of 45 degrees toward the lower sidewalk, was not such an inequality as to make the city guilty of negligence, and liable to one injured by stumbling over it in daylight.—Supreme Court of Louisiana, 64 S. R., 762.

Defective Sidewalks—Contributory Negligence.

Overton v. City of Waterloo.—Where the attention of a pedestrian, while walking along a city street in the daytime was attracted to goods in a store window, and she stepped into a defect in the sidewalk and fell and was injured, she was not guilty of contributory negligence as a matter of law.—Supreme Court of Iowa, 145 N. W. R., 889.

Defective Streets—Contributory Negligence.

Fountain v. City of Des Moines.—That the driver of a vehicle, the wheels of which went into a ditch in the street, causing it to tip over, knew the ditch was there did not in itself show negligence as a matter of law.—Supreme Court of Iowa, 146 V. W. R., 881.

Constitutional Law.

Ranney v. City of Cape Girardeau.—In order to bring an appeal within the jurisdiction of the Supreme Court on a constitutional ground, it must appear that a constitutional question is essential to the determination of the case, and the record must show that a constitutional question was not only raised in the trial court, but was ruled on to the disadvantage of the party appealing.—Supreme Court of Missouri, 164 S. W. R., 582.

Condemnation of Property—Compensation of Commissioners.

Gloucester Water Supply Co. v. Freeman.—The parties to a proceeding to assess the compensation to be made for property taken by a city, commenced while the law required payment for the commissioners' services to be made by the parties, could contract with the commissioners for the payment of reasonable compensation.—District Court, D. Massachusetts, 211 F. R., 348.

NEWS OF THE SOCIETIES

Calendar of Meetings.

May 11-15.
AMERICAN WATER WORKS ASSOCIATION.—Thirty-fourth Annual Meeting, Philadelphia, Pa. J. M. Diven, secretary, 47 State street, Troy, N. Y.

May 12-14.
AMERICAN ASSOCIATION FOR THE PROMOTION OF HYGIENE AND PUBLIC BATHS.—Annual Convention, Newark, N. J.

May 14-15.
NORTH CAROLINA ASSOCIATION OF MAYORS.—Annual convention, Charlotte.

May 18-23.
FIRST CANADIAN AND INTERNATIONAL GOOD ROADS CONGRESS.—The Arena, Montreal, P. Q. G. A. McNamee, General Secretary, New Beiks Buildings, Montreal.

May 20-30.
ELECTRICAL LEAGUE OF CLEVELAND, O.—Exposition, Coliseum, Cleveland, O. W. G. Rose, Manager, Illuminating Building, Cleveland.

May 26-28.
CITY MARSHALS AND CHIEFS OF POLICE ASSOCIATION OF TEXAS.—Twentieth Annual Convention, San Antonio. C. W. Newby, Secretary, Fort Worth.

June 1-3.
NATIONAL CONFERENCE ON CITY PLANNING.—Annual Meeting, Toronto, Canada. Flavel Shurtleff, Secretary, 19 Congress street, Boston, Mass.

June 1-5.
NATIONAL ELECTRIC LIGHT ASSOCIATION.—Thirty-seventh Convention, Bellevue-Stratford Hotel, Philadelphia, Pa. T. C. Martin, Secretary, 29 West 39th street, New York City.

June 3-5.
CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS OF THE STATE OF NEW YORK.—Fifth Annual Conference Auburn, N. Y. W. P. Capes, Secretary, 105 East 22d street, New York City.

June 23-25.
SOUTH CAROLINA STATE FIREMEN'S ASSOCIATION.—Tenth Annual Meeting and Tournament, Florence, Ala. R. S. Hovel, Secretary, Sumpter, S. C.

June 30-July 4.
AMERICAN SOCIETY FOR TESTING MATERIALS.—Seventeenth Annual Meeting, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, Secretary, University of Pennsylvania, Philadelphia, Pa.

October 20-23.
INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.—Annual Convention, New Orleans, La. James J. McFalls, Secretary, Roanoke, Va.

Dec. 14-17.
AMERICAN ROAD BUILDERS ASSOCIATION Annual Congress and Exposition, International Amphitheatre, Chicago, Ill. E. L. Powers, secretary, 150 Nassau Street, New York City.

June 15-17.
SOUTHEASTERN WATER WORKS ASSOCIATION.—Third Annual Convention, New Convention Hall, Tulsa, Okla. E. L. Fulkerson, Secretary-Treasurer, Waco, Texas.

INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE—Annual Convention, The Morton House, Grand Rapids, Mich. Supt. Carr, Secretary, Grand Rapids.
Sept. 11-12.

STATE FIRE MARSHALLS' ASSOCIATION OF NORTH AMERICA.—Annual Convention, Asheville, N. C.

Aug. 18, 19, 20.
FIREMEN'S ASSOCIATION OF THE STATE OF NEW YORK.—Geneva, N. Y.

June 23-26.
SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION.—Annual Convention. Prof. H. H. Norris, Secretary, Ithaca, N. Y.

Southwestern Water Works Association.

At the third annual convention of the society to be held June 15, 16, 17 in Tulsa, Okla., the following program will be observed:

On June 15: Opening address by F. M. Worden, Mayor. Response to welcome by T. J. Powell, Fort Worth. Regular business and reports from committees.

Addresses: Modern Machinery for Water Works Pumping, by C. Schultz; Municipal Ownership of Water Works, by R. R. Nelms; Reciprocal Rights and Obligations of Water Companies and the Public They Serve, by R. Beaton; Some Leaks, by H. L. Duffe; Collections, by R. H. Haynes; Practical Management of Water Works, by N. A. Bittick; Discussion of Pure Water by R. E. McDonnell.

On June 16.—Addresses: The History and Discussion of the Water Works of Tulsa, Okla., by L. L. Ballard; Economical Power Covering, by C. H. Ade; Description of Waco, Tex., New Filter Plant, by F. B. Leopold; Legislative Control of Municipal and Privately Owned Water, by J. R. Ramsey; The Detail and Practical Construction of Settling Basins and Reservoirs of Concrete, by T. C. Huges. Trips to points of interest and entertainment.

On June 17.—Election of officers and entertainment.

Electric Conclave in Iowa.

An electric conclave attended by three important state organizations, the Iowa section of the National Electric Light Association, the Iowa Street and Interurban Railway Association, and the Iowa Electrical Contractors' Association convened at Cedar Rapids, April 22, 23 and 24. The greater part of the time was taken up in addresses, papers and general discussions on electrical developments throughout the state of Iowa and the United States.

National Drainage Congress.

Choosing officers and selecting Washington, D. C., for the next annual convention, the National Drainage Congress, which held its meeting in Savannah, Ga., wound up all business and adjourned on April 24, after hearing an address by Sir William Willcocks, K. C. B., on "River Regulation and Control in Antiquity."

The officers elected were as follows: President, E. J. Watson, of South Carolina; vice-presidents, F. B. Knight, Illinois; D. E. King, Missouri; Gen. W. C. Gorgas, U. S. A.; Edward Wisner, Louisiana, and J. L. Craig, California; treasurer, A. M. McLachlen, District of Columbia.

Sir William Willcocks was elected honorary vice-president and the title of honorable past-president was permanently bestowed on the retiring president, Edmund T. Perkins, of Illinois.

The convention adopted resolutions recommending an international drainage and flood control congress at San Francisco in 1915.

American Anti-Congestion League.

The 22nd convention which was added recently to the world series of congresses and conventions scheduled to hold their 1915 sessions at the Panama-Pacific International Exposition in San Francisco is the American Anti-Congestion League. This important organization, which is engaged in counteracting the drift cityward and is promoting the "back-to-the-land" movement, was secured for San Francisco through the active influence of Congressman J. E. Baker and Julius Kahn, both of California, who, with about twenty other members of Congress and governors of states are members of the executive committee of the league. Announcement to this effect was made recently in a telegram to San Francisco from A. L. Cowell, field secretary of the Bureau of Conventions and Congresses, who is now in New York.

The American Society of Mechanical Engineers.

A meeting of the society will be held on Tuesday, May 12th, in New York, at which H. de B. Parsons, member of the Metropolitan Sewerage Commission, will give an illustrated talk on main drainage and sewage disposal plans for the city of New York. He will also speak of the main drainage works of Boston, London, Paris, Berlin and other cities.

National Electric Light Association.

A committee of the National Electric Light Association has been formed for the purpose of bringing about closer relations between the association and the engineering colleges.

At a recent meeting of the committee, composed of twenty-four members, the opinion was expressed that engineering graduates who had entered their employ have been most generally found lacking in a knowledge of, and often even an appreciation for, the business and economic side of engineering. A strong plea was made by several central station men that more attention be given to economics in engineering courses, particularly in mechanical and electrical engineering.

Tri-State Water and Light Ass'n.

Resolutions to pave the way for enlargement of the Tri-State Water and Light Association of the Carolinas and Georgia so as to include all states throughout the South were adopted at the closing session of the organization's fourth annual convention in Atlanta, Ga. Perfection of the plans were left to the executive committee. The following officers were elected: President, F. C. Wyse, Columbia, S. C.; first vice president, J. W. Neave, Salisbury, N. C.; second vice president, Hugh Hill, West Point, Ga.; third vice president, E. R. Fluke, Sparta, Ga.; secretary-treasurer, J. C. Barnwell, Rock Hill, S. C.

Indiana Mayors Elect Officers.

Mayors of Indiana cities elected officers on April 29, for a permanent organization of mayors, and Mayor Joseph E. Bell of Indianapolis was chosen as their first president. Other officers of the organization are: First vice president, R. P. Johnson of Gary; second vice president, J. W. McCarty, Washington; secretary, A. C. Sallee, former secretary to Mayor Bell; treasurer, Rollin H. Bunch, Muncie; execu-

(Continued on page 685.)

NEW APPLIANCES

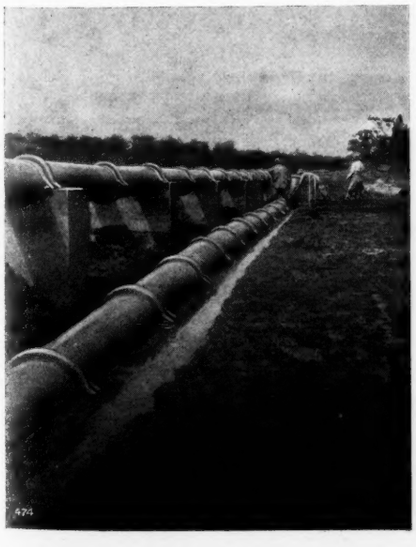
UNIVERSAL JOINT PIPE.

Pipes Joined Without Lead.

In piping systems the pipe employed must naturally have the utmost resistence to corrosion or decay and the joints must be as nearly like the pipe body itself as possible so that no failure may occur at this most important point. Universal pipe, made by the Central Foundry Co. of New York has been employed on many of the most important municipal water supply and sewage disposal undertakings for some time, and seems to have met these conditions.

The Universal joint is composed of the hub and spigot ends of the cast iron pipe machined to slightly varying tapers, so that when drawn together by bolts passing through lugs cast on the ends of the pipe, a joint is formed which is at once tight and yet admits of a considerable amount of movement. So much flexibility is obtained in this joint that straight lengths of pine can be laid on a curve of comparatively small radius by merely offsetting the joints. No packing, caulking or gaskets of any description are used in the joints so that there is nothing to become affected or rotted out by the action of the sewage or other active material which may be carried in the pipe, and since the joint is entirely of cast iron itself its life is equal to that of the pipe.

We illustrate here two parallel lines of Universal Pipe laid under widely varying conditions, a 12 inch line being supported on concrete piers, while a 16 inch line is laid in a water-filled trench. These pipe lines are being built up as fast as the lengths of pipe can be put in place, the entire joint making operation requiring but a few moments time for each joint, as all there is to do is to slip the ends of the pipe together, put a couple of bolts through the lugs, and take up on the nuts with a ratchet wrench. The 12 inch line is a force main to disposal works, the larger pipe being an effluent line. The former extends about 14,000 feet and the latter about 3,000 feet, and constitute an extremely important section of the Rye, New York, sewage disposal system.

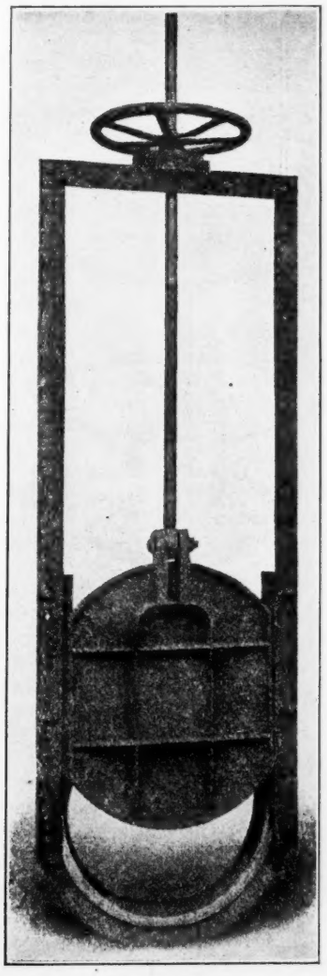


UNIVERSAL PIPE AT RYE, N. Y.

LIGHT PRESSURE GATE.

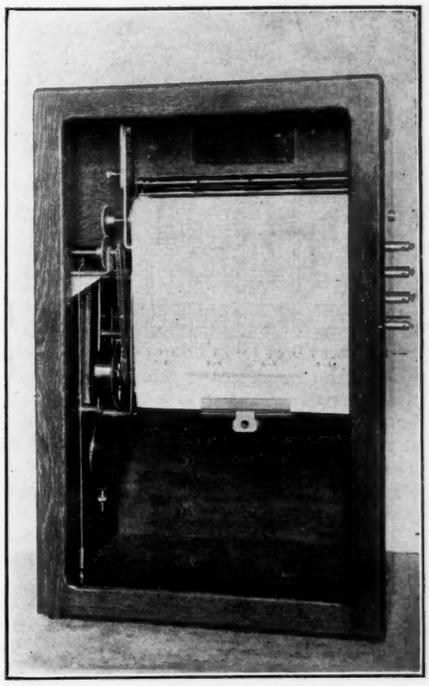
The Hinman Hydraulic Manufacturing Co., Denver, Col., specialize in the manufacture of appliances for the control and transportation of water. They claim for their products efficiency in operation and simplicity in design.

Among the various kinds of gates manufactured is the Light Pressure Gate designed especially for the use of small reservoirs, where a slight leakage means wasted water. These gates are intended for a depth of water from 20 to 25 feet. The thickness of metal is not slighted for these depths of water, but, on the other hand, it is not excessive. The different parts have a thickness which is carefully determined within a reasonable margin of safety.



HINMAN GATE.

Any kind of pipe may be used with these gates—vitrified, cast iron, cement, wood stave or steel, either slip joint or flanged.



THWING PYROMETER.

The Hinman concern also makes a well-constructed metal flume known as "Hydroduct," which is manufactured along strictly scientific lines.

PYROMETERS.

Used to Record at a Distance the Temperature of Tanks at Asphalt Plants.

Thwing Instrument Co., 445 North Fifth street, Philadelphia, Pa., manufacture indicating and recording pyrometers of a variety of designs. That shown in the illustration is of a type used in asphalt paving plants to show the temperature of the tanks throughout the 24 hours. The instrument would ordinarily be placed in the office and, in the most complete equipments, an indicator is located at some place in the plant, presumably on the mixing platform.

The instrument records by means of a galvanometer needle which is periodically depressed upon the chart. The chart is carried forward by means of a suitably geared, powerful pendulum clock. At each depression an ink mark is made upon the chart at a point corresponding to the temperature and the time. At frequent intervals the galvanometer is automatically disconnected from its thermo-couple or resistance bulb and allowed to return to zero, at which point the needle is de-

pressed upon an ink pad and is then ready for making another record. The time occupied in making a single record may be varied to secure one, two or three records per minute.

By means of the multiple contact mechanism several records may be made from as many heat sources by one galvanometer upon a single chart or section of chart. Or several galvanometers may be mounted side by side in the same case. Thus a 10-inch chart may be divided into from two to five temperature ranges, which need not be alike in range or method of treatment. Charts are printed on a paper from which blue prints may easily be taken.

FEED WATER REGULATOR.

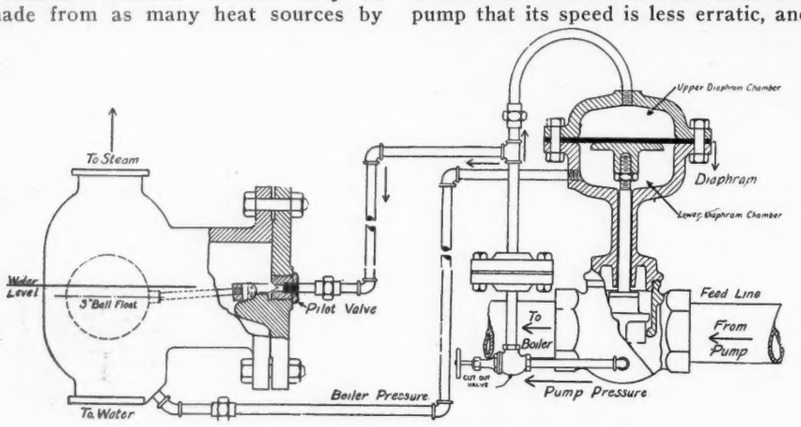
Water Kept At Constant Level—Feed Pump Speed Less Erratic.

In order to cause the feed water to flow into a working boiler, the pressure carried in the feed water main must be slightly above the pressure carried in the boiler. In the "Watch Dog" feed water regulator, it is claimed that the pressure in the feed water main acts on the under side of the valve disc of the controlling valve, tending to force it open, but it is more or less counteracted by the pressure in the main beyond, acting downward on the disc.

This pressure also acts on the under side of the diaphragm, adding another pressure also tending to open the controlling valve. This is more or less counterbalanced by the pressure produced on top of the diaphragm. This latter pressure is obtained by by-passing a trifle of the feed water around the controlling valve and discharging it into the boiler through the pilot valve in the regulator chamber, the by-pass being connected to chamber on top of the diaphragm.

The float in the regulator chamber rises and falls with the rise and fall of the water level in the boiler, and the pilot valves act correspondingly, thereby increasing or decreasing the pressure on the top of the valve diaphragm, and closing the controlling valve in case height of the water in the boiler is increasing, and opening the valve in case of water falling, but never entirely opening or closing the valve except under extreme conditions.

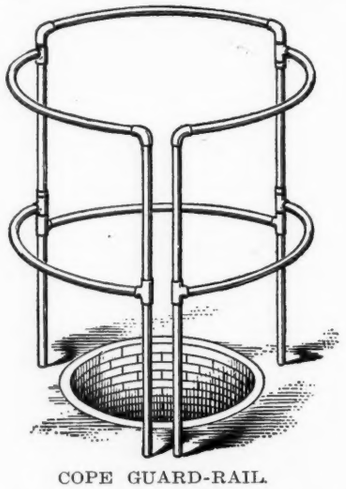
The "Watch Dog" feed water regulator, which is manufactured by L. J. Wing Mfg. Co., New York, is said not only to keep the water level constant but to feed continuously, varying the quantity fed with requirements. This means in the case of a boiler feed pump that its speed is less erratic, and the size of the pump required is that to take care of the maximum load on the boiler plant.



"WATCH DOG" FEED WATER REGULATOR.

Electrical Underground Construction Tools.

T. J. Cope, 3244 North Fifteenth street, Philadelphia, Pa., manufactures a complete line of construction tools, of which the Cope manhole guard-rail is shown. This device prevents many an accident and on account of its light weight and the fact that it folds up when not in use is very little trouble to carry about. One of the Cope leaders is the conduit threading machine. This device threads conduits of any material or shape from one to twenty inches in diameter. It is worked from the surface of the street, is pliable, and can be bent to enter or be withdrawn from manholes 15 inches in diameter. With it ducts have been run 1,300 feet between manholes. Every movement of the lines moves the machine forward from 4 to 5 feet. Operators make about 60 pulls a minute.



COPE GUARD-RAIL.

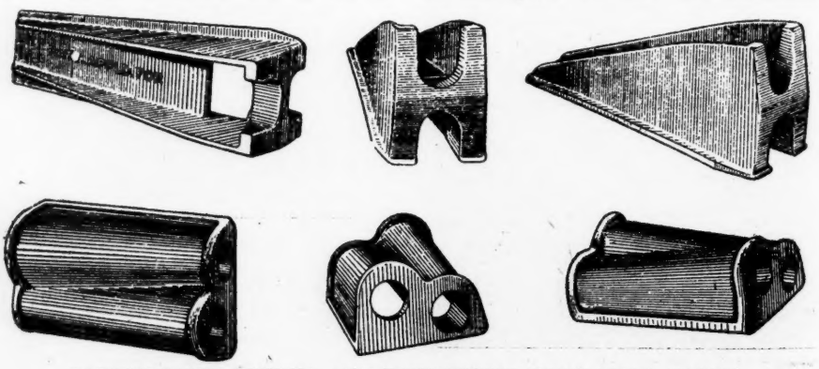
Other Cope appliances are conduit rods, cable racks, cleaning tools, wire reels, pulling wire rope, winches, capstans, reel jacks, pulling rigging, attaching plates, shoring jacks, duct protectors, high tension terminals, etc.

Castings for Wood Pipe.

The use of continuous wood stave pipe for water supply, power transmission and other purposes is now well established. Among the engineering difficulties which have been encountered and worked out satisfactorily has been the production of a suitable shoe or clamp for joining and tightening the bands. The practice is now general of using malleable iron shoes, the standard sepcifications demanding that shoes shall be designed of minimum weight, yet capable of breaking the bands with which they are used. The Marion Malleable Iron Works, Marion, Ind., have made castings of this sort for twenty years and deserve credit for aiding in establishing the present standard of efficiency in the shoes now on the market. The illustration shows some of their designs that are carried in stock and besides they have patterns suitable for any size shoe for pipe twelve inches to twenty feet in diameter. The castings are dipped or painted according to any specifications. The company recommends, however, the use of P. B. H. Special rust proof paint.

ELECTRIC POWER PUMP.

Due to its many advantages, the electric-driven power pump is said to be well adapted for use in pumping stations attached to water works, where this item of operating expenses is sought to be kept at a minimum. The electric power pump utilizes the highest efficiency of the electric motor and gives the user the maximum

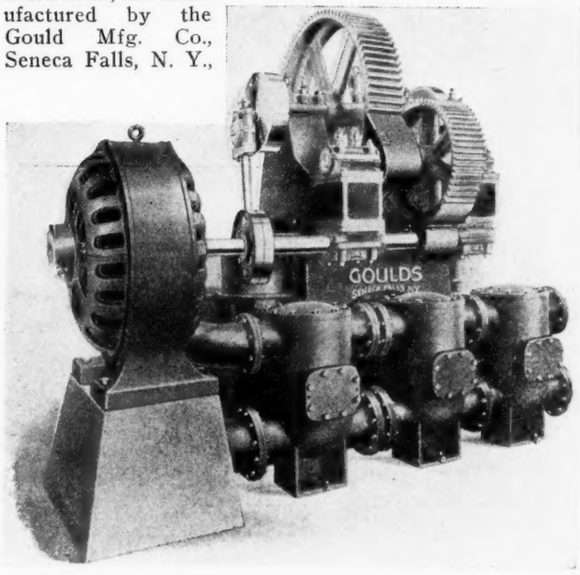


CASTINGS FOR JOINING AND TIGHTENING WOOD PIPE BANDS.

pumping service for the power consumed.

This type of pump requires little attention and can be made to operate automatically. The simplicity of the electric pump reduces the maintenance cost. Then, too, such a pump is clean and quiet, and can be readily moved from place to place because it is entirely self-contained.

The outfits, such as shown in the illustration, are manufactured by the Gould Mfg. Co., Seneca Falls, N. Y.,



GOULD'S ELECTRIC POWER PUMP.

They are supplied with pumps and motors connected by various methods to meet different conditions. For instance, the motor may be connected to the pump by belt, or to the pump shafts by a coupling. Another possibility exists of connecting the motor and pump by gears and pinions.

The pump illustrated is a double-acting triplex piston pump made for large capacity service. This pump has three double-acting pistons and consequently has nearly twice as great capacity as single-acting triplex pumps with the same cylinder diameters and strokes. This electric power Gould pump is made in capacities ranging from 175 gallons per minute to 2,270 gallons per minute, and is used largely for general water supply and municipal water works.

Boyd Apparatus Deliveries.—A few recent deliveries made by James Boyd & Brother, Inc., Philadelphia, are: Council Bluffs, Ia., one combination chemical and hose car; Wichita, Kansas, one large six-cylinder hose car; Wilmington, Del., one gas electric aerial ladder truck; Newark, N. J., one pumping engine and one gas-electric aerial ladder truck; Highland Park, Mich., one city service truck; Alhambra, Cal., one city service truck; West Chester, Pa., one combination chemical and hose car; Pottsville, Pa., one combination chemical and hose car; and Austin, Tex., one combination chemical and hose car.

INDUSTRIAL NEWS

Cast Iron Pipe—Chicago Quotations—4 inch, $26; 6 to 12 inch, $24; 16 inch and up, $23.50. Birmingham Quotations—4 inch, $21; 6 inch and upward, $19. New York—The private demand is irregular but the volume is larger than in the month of March; competition continues keen. Quotations—6 inch carloads, $22 to $23.

Lead.—Quotations, New York—$3.90; St. Louis, $3.80.

Culvert Pipe.—At a recent letting for culvert pipe, April 10, at Waycross, Ga., representatives of twelve firms were on the ground. They were: R. M. Whitcomb, of Mobile, Ala., representing the New Orleans Metal and Roofing Works, who landed the order; Galion Iron Works and Manufacturing Company, of Galion, O., by E. I. Coolidge; Good Roads Machinery Company, by W. P. Brooks; Salisbury Metal Works, by H. C. Tuggles; Florida Metal Products Company, by J. W. Sargon and R. A. Cunningham; Harry Brothers, by W. E. Yancey; Dixie Metal Works, by C. H. Rivers, and H. P. Dixon; Birmingham Metal Products Company, by J. A. Bell; Finley Brick Company, by J. A. Porter.

Waterproof Portland Cement.—The McCormick Waterproof Portland Cement Co., Chamber of Commerce Building, Chicago, Ill., advises us that no infringement or other decree against the McCormick Waterproof Portland Cement Company is in force. Litigation between that company and the Medusa Company is now pending in the United States Circuit Court of Appeals, but the case has not been passed upon by that tribunal.

Handling Direct.—The Buffalo Foundry & Machine Co. of Buffalo, N. Y., announce that they have terminated the arrangement whereby Mr. H. E. Jacoby has been representing them in New York City and vicinity. They are now handling direct all inquiries covering vacuum apparatus, castings, patterns and machine work.

Agencies Opened.—George Griffiths, 418 Odd Fellows Building, St. Louis, Mo., and G. A. Cleaver, 112½ Main Street, Houston, Tex., have taken on the agency in their respective territory for the Chain Belt Concrete Mixer, Paver and the Chain Belt line of distributing spouts and towers and other concrete machinery manufactured by the Chain Belt Company, Milwaukee, Wis.

Texas Roads.—An idea of the activity in road construction in Texas during recent years may be obtained from a glance at the record of the amount of bonds authorized at elections. They are as follows: 1909, $781,000; 1910, $4,015,000; 1911, $8,915,500; 1912, $3,496,200; 1913, $7,267,700.

NEWS OF THE SOCIETIES.

(Continued from page 682.)

tive committee, Benjamin Bosse, chairman, Evansville; F. W. Keller of South Bend, H. C. Volland of Columbus, J. L. Watkins of Newcastle, Thomas Bauer of Lafayette.

Through the new organization the mayors hope to work out better plans for law enforcement for civic improvements and for favorable legislation. The nominating committee was composed of Mayors J. H. Mellett of Anderson; Alonzo K. Grant of Mt Vernon, and Thomas Bauer of Lafayette, was appointed by Mayor Joseph E. Bell, the chairman of the meeting.

PERSONALS

The following mayors have recently been elected in Wisconsin:

Jefferson—J. W. Brewer.
Beloit—H. W. Adams.
*Beaver Dam—F. J. Mirlach.
*Superior—J. S. Konkel.
Merrill—F. J. Smith.
Dodgeville—John A. Campbell.
*Marshfield—A. G. Felker.
Prairie du Chien—F. H. Poehler
Neenah—C. B. Clark.
Wasburn—Ed. Bryan.
New London—A. C. Herman.
Plymouth—Sparrett.
Stevens Point—Dr. Tasternaski
Waukesha—A. J. Dopp.
Trempealeau—Wabright.
Lodi—Robert Caldwell.
New Lisbon—W. B. Coapman.
Cedarburg—John Armbruster.
Washburn—Edward Bryan.
Antigo—Dr. G. D. Steffen.
*Edgerton—A. E. Skinner.
Juneau—H. S. Drente.
Shell Lake—Andrew Ryan.
Darlington—Dr. W. W. Peck.
Black River Falls—J. J. McGillvray.
*Depere—John Seckert, Jr.
Lake Mills—W. E. Penn.
*Shawano—B. Royer.
Princeton—William Gou.
Glenwood City—Salscheider.
*Wausau—John Ringle.
Camp Douglas—Leo Wilkinson.
*Bamboo—C. T. Theurer.
Fennimore—D. T. Parker.
Galesville—N. S. Wadleigh.
*Needah—G. H. Levernash.
Ripon—A. L. Mandlin.
Madison—Adolph H. Kayser.
Platteville—A. W. Prosser.
Watertown—C. A. Kading.
*Fort Atkinson—George A. Eales.
Grantsburg—H. A. Anderson.
Mayville—Charles Mass.
Tomah—H. B. Vandell.
Oconomowoc—Hugo A. Ernst.
Tomahawk—R. C. Thielman.
*Colby—I. E. Lyons.
Alma Center—J. L. Ringrose.
Kenosha—M. J. Scholey.

ADVANCE CONTRACT NEWS

ADVANCED INFORMATION
BIDS ASKED FOR

CONTRACTS AWARDED
ITEMIZED PRICES

To be of value this matter must be printed in the number immediately following its receipt, which makes it impossible for us to verify it all. Our sources of information are believed to be reliable, but we cannot guarantee the correctness of all items. Parties in charge of proposed work are requested to send us information concerning it as early as possible; also correction of any errors discovered.

BIDS ASKED FOR

STATE	CITY	REC'D UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
			STREETS AND ROADS	
Ind.,	Hamilton	10 a.m., May 9	Constructing gravel road	Co. Comrs.
Ill.,	Chicago	11 a.m., May 9	Furnishing 7,000 cu. yds. crushed granite	L. E. McGann, Comr. Pub. Ser.
Pa.,	Hollidaysburg	May 10	15,000 sq. yds. brick for concrete pavement and curb	J. L. Henry, Boro. Engr.
N. J.,	Newark	3 p. m., May 11	Furnishing and delivering broken stone for county roads	F. Q. Reimer, Co. Engr.
N. J.,	Highland Park	8 p. m., May 11	Laying and constructing sidewalks	F. A. Metzrath, Boro. Clerk.
Ill.,	Joliet	10 a.m., May 11	Improvements on several streets	A. M. Barry, Clerk.
Ind.,	Peru	May 11	Roads in several townships	F. J. McElheny, Auditor.
Pa.,	Norristown	May 11	Crushed trap rock, crushed limestone, vit. block	F. C. Corson, City Engr.
O.,	Girard	noon, May 11	Constructing and repairing all sidewalks	R. L. Sanford, Vil. Clerk.
N. J.,	Milburn	May 11	60,000 sq. yds. road, with asphaltic oil or refined coal tar	Twp. Committee.
Ia.,	Fort Dodge	9 a.m., May 11	31,274 sq. yds. paving and about 29,041 ft. curb and gutter	W. L. Tang, City Clerk.
Ill.,	Cicero	8 p.m., May 11	Paving with asphaltic concrete	C. Jepsen, Pres. B. L. I.
O.,	Columbus	Noon, May 11	Improving and macadamizing several streets	Board Co. Comrs.
Ind.,	Jasper	10 a.m., May 11	Road work	Co. Comrs.
Fla.,	Orlando	2 p. m., May 11	Grading and paving with brick, five highways	Orange Co. Comrs.
N. Y.,	Cortland	May 11	9,875 sq. yds. vit. brick or block, 4,335 ft. sandstone curb	Board Pub. Works.
N. Y.,	Albany	1 p.m., May 11	Improving and repair work in several counties	J. N. Carlisle, Comr.
Pa.,	Norristown	8 p.m., May 11	Furnishing crushed trap rock, vit. block, Portland cement and vit. pipe	D. Sinclair, Chr. Hwy. Comn.
Ind.,	Jasper	10 a.m., May 11	Rock roads	J. H. Seng, Co. Aud.
N. J.,	Jersey City	4 p.m., May 11	Improving five streets	M. I. Fagen, City Clerk.
N. Y.,	Charlotte	8 p.m., May 11	Bituminous pavement and sanitary sewer	W. E. Hoban, Clerk.
N. H.,	Windham	1 p.m., May 11	Grading and surfacing with gravel	S. P. Hooker, State Supt. Hwys., Concord.
Mo.,	St. Louis	Noon, May 11	3,000 gallons, more or less, road oil for year ending April, 1915	S. P. Thomas, Comr. Supplies.
Ill.,	Elgin	10 a.m., May 12	Brick and asphaltic concrete pavement	Board Local Imps.
Pa.,	Philadelphia	10 a.m., May 12	Supplying paving bricks	Navy Dept., Wash., D. C.
Md.,	Annapolis	10 a.m., May 12	Furnishing road oil and gravel	Navy Dept., Wash., D. C.
N. Y.,	Buffalo	11 a.m., May 12	Paving in five streets	F. G. Ward, Comr. Pub. Wks.
Pa.,	Pittsburgh	10 a.m., May 12	Improvements on several roads	R. J. Cunningham, Co. Cont.
N. Y.,	Albany	1 p.m., May 12	Improving and repair work in several counties	J. N. Carlisle, Comr.
O.,	London	Noon, May 12	Grading and paving with various materials	J. W. Byers, Vil. Clerk.
O.,	Montpelier	May 12	15,000 sq. yds. paving	Village Clerk.
Minn.,	Walker	10 a.m., May 12	Clearing and grubbing about 34.5 acres	I. P. Byrhe, Auditor.
Neb.,	Omaha	10 a.m., May 12	Paving and curbing streets, various materials	T. J. Flynn, City Clerk.
N. J.,	Woodbridge	8.30 p. m., May 13	Furnishing 30 carloads crushed trap rock	A. Keyes, Twp. Clerk.
Kan.,	Kansas City	May 12	Grading one road	Board Comrs.
Wis.,	Green Bay	10 a. m., May 12	Putting gravel on roads	Office Committee on Sts.
Md.,	Baltimore	noon, May 12	Seven sections of state highway, about 23.74 miles	O. E. Weller, Chr.
Ill.,	Elgin	May 12	Asphaltic concrete and brick pavements	M. H. Brightman, Engineer.
O.,	Piqua	10 a.m., May 12	Improving road by grading and laying crushed stone	County Comrs.
Mont.,	Glasgow	8 p.m., May 13	Cement sidewalks, curbs, crossings and street lighting system	E. E. Crawford, City Clerk.
Tenn.,	Knoxville	noon, May 13	Paving work	D. G. Leahy, Recorder.
N. J.,	Freehold	May 13	Constructing section of road	J. M. Corlies, Dir.
N. J.,	Freehold	11 a.m., May 13	Constructing section of gravel road	J. M. Corlies, Dir.
O.,	Cleveland	11 a.m., May 13	Repairing roads	E. G. Krouse, Clerk.
Wis.,	Fond du Lac	May 14	Improving 4 streets with reinforced concrete pavement	J. S. McCullough, C. E.
Minn.,	Falls City	2.30 p.m., May 14	Paving in five districts; cost, about $47,000	G. Riechers, City Clerk.
S. D.,	Tulare	2 p.m., May 14	Grading one mile road	J. Avery, Town Clerk.
Me.,	Fryeburg	May 14	Grading and surfacing with gravel, about 7 miles	State Hwy. Comsn., Augusta.
Me.,	Augusta	May 14	Building sections of post road, about 21.91 miles	State Hway. Comsn.
N. J.,	Linden	8 p. m., May 14	Laying bluestone sidewalk	C. A. Smith, Boro Clerk.
Ind.,	Noblesville	2 p.m., May 15	Highways in two townships	W. O. Horton, Auditor.
O.,	St. Clairsville	May 15	Paving three sections National Pike, $100,000	County Comrs.
Pa.,	York	May 15	About 70,000 sq. yds. vit. block, etc	City Clerk.
O.,	Cincinnati	noon, May 15	Improving both pike and road	Co. Comrs.
Idaho,	Kellogg	May 15	Constructing concrete pavement, cost $12,000	City.
Wis.,	Richland Center	4 p.m., May 15	About 6,056 sq. yds. reinforced concrete curbing; also curbs and concrete waterways	O. H. Kidd, Chm. Bd. P. Wks.
O.,	East Liverpool	noon, May. 15	Paving with brick or paving blocks; eight jobs	E. J. Smith, Dir. Pub. Ser.
O.,	Coshocton	about May 15	1½ miles brick and slag road	J. R. Marker, Comr., Columbus.
Ind.,	Noblesville	10 a. m., May 15	Two gravel roads	County Comrs.
Pa.,	York	Noon, May 15	70,000 sq. yds. vit. brick or other material for paving	G. A. Warner, City Engr.
O.,	Cleveland	Noon, May 15	Paving portion of street	A. R. Callow, Comr. P. & Sup.
Mo.,	St. Louis	Noon, May 15	Paving and reconstructing streets	Board of Pub. Imps.
Ind.,	Sullivan	May 16	Constructing three roads, crushed stone and gravel	W. L. Sisson, Co. Surv.
Minn.,	North Branch	11 a.m., May 16	Clearing, grubbing, turnpiking, 47,000 lin. ft.; also concrete and corrugated culverts	A. F. L. Strongren, Auditor.
Tex.,	San Antonio	May 16	78 miles gravel road; 2,700 cu. yds. concrete culvert	V. H. Howard, Auditor.
O.,	Marion	noon, May 16	Grading, rolling and macadamizing	Road Comrs.
N. J.,	New Brunswick	May 18	Paving about 62 streets	City Clerk.
Minn.,	Waseca	2 p.m., May 18	Oil tractors and graders	T. Peterson, Auditor.
Mont.,	Helena	noon, May 18	Cement walks	R. N. Hawkins, Sec. State Bd Examiners.
O.,	Lisbon	1 p.m., May 18	Constructing 2⅓ miles of road	J. C. Billingsley, Pres.
Tenn.,	Memphis	May 19	Paving one street, cost $45,000	J. R. Weatherford, C. E.
Wash.,	Rosalia	May 19	Improving about 8.7 miles	State Hwy. Bd., Olympia.
Tex.,	Temple	May 20	Road construction	City Clerk.
Pa.,	Franklin	7 p. m., May 20	13,000 sq. yds. brick on concrete	J. G. Crawford, Clerk.
Tenn.,	Bluff City	May 21	25 miles of graded and macadam roads	Chr. Pike Roads Comm.
Minn.,	Elbow Lake	10 a.m., May 22	Three road construction jobs	O. E. Wolde, County Aud.
N. J.,	Milburn	May 25	Constructing road	City Clerk.
Minn.,	Crookston	2 p.m., May 26	10,000 ft. road work requiring 15,555 cu. yds. material	S. J. Welter, Auditor.

BIDS ASKED FOR

STATE	CITY	REC'D UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
O.	Canton	May 29	Constructing about 8 miles of road	Co. Comrs.
O.	Canal Dover	about June 1	Constructing brick pavement	W. E. Sykes, Dir. P. S.
O.	Bowling Green	1 p.m., June 2	Grading, draining, macadamizing and applying tar binder	C. E. Stinebaugh, Co. Aud.
Ind.	Logansport	10 a.m., June 4	Constructing road	C. E. Medland, County Aud.

SEWERAGE

Sask.	Estevan	9 p. m., May 9	16,000 feet sewer pipe to be laid	Sec.-Treas.
Wis.	Racine	10 a.m., May 9	Constructing sewers in various streets	Board of Public Works.
Wash.	Cashmere	May 10	Three stage vertical centrifugal pumps and vertical type 30-h. p. motor	Town Clerk.
Pa.	Lebanon	May 11	Vit. pipe sewers, manholes, flush tanks, etc	T. R. Crowell, C. E.
Mont.	Miles City	May 11	Sanitary storm sewers	J. E. Farnum, City Clerk.
Ill.	Joliet	10 a. m., May 11	Constructing sewer system in several streets	Bd. Local Imp.
N. Y.	Cortland	7 p.m., May 11	370 ft. 24-in., 280 ft. 15-in. vit. pipe, etc	Board of Public Works.
Ind.	Indianapolis	10 a.m., May 11	Reinforced concrete drain	Board of Public Works.
Ill.	Moline	10 a.m., May 12	Sewerage and water mains	M. R. Carlson, Pres.
Pa.	Philadelphia	noon, May 12	Constructing sewer	M. L. Cook, Dir.
N. Y.	Brighton	May 12	Storm and sanitary sewer, disposal plant, etc	Sewer Comrs.
Sask.	Regina	May 12	Supplying sewer pipe, sewer brick, manhole covers and frames, etc	City Comrs.
Sask.	Kamsack	2 p.m., May 13	Sewerage system with disposal plant, also water works system	A. A. Crawford, Sec.-Treas.
Mich.	Charlotte	May 13	Four-mile drain	Mr. Melbourne, Co. Comr.
N. Y.	Brooklyn	May 13	Constructing storm water sewer	L. H. Pounds, Pres.
Pa.	York	Noon, May 15	Storm water and sanitary sewers	G. A. Warner, City Engr.
O.	Lancaster	Noon, May 15	Constructing lateral sewer	J. A. Mayer, Dir. Pub. Serv.
Pa.	York	noon, May 15	Sanitary and storm sewers	City Clerk.
N. Y.	Goshen	1.30 p.m., May 15	Sewer system and sewage disposal plant	G. F. Gregg, Vil. Pres.
N. Y.	Hudson	about May 15	Constructing 1,000 ft. 15-inch tile sewer	O. J. O'Hara, City Engr.
Mo.	Dexter	8 p.m., May 18	Sewerage system	W. Watkins, Mayor.
N. Y.	Albany	3 p.m., May 18	Constructing sewage disposal plant and intercepting sewer	I. Wachsman, Sec. of Board.
La.	Kinder	May 18	Drainage ditches and canal	L. M. LaFleur, Sec. Drain. Dis.
Md.	Baltimore	May 20	Lateral sewers and house connections	Sewerage Comsn.
Iowa	Greene	7.30 p.m., May 20	Sewers, disposal plant and outlet sewers	Leroy Niles, Town Clerk.
O.	Struthers	May 20	Storm and sanitary sewer	Village Clerk.
N. J.	Elizabeth	May 20	Sewers in several streets	W. P. Neafsey, St. Comr.
Ill.	Chicago	May 21	Excavation work, etc., on channel	J. McGillan, Clerk.
O.	Nelsonville	Noon, May 23	Constructing sewer in one street	R. S. Weitzell, Dir. Pub. Serv.
Pa.	Lebanon	May 25	55,000 ft. vit. pipe sewer	T. R. Crowell, City Engr.
Ore.	Portland	3 p.m., May 28	Concrete diversion dam, head work, etc	U. S. Reclam. Serv.
Wis.	Wittenberg	June 1	Sewer and water works, $30,000	A. Johnson, Vil. Pres.
Ill.	Elgin	June 15	36,000 ft. 6 to 15-in. sewer	M. H. Brightman, Engr.
La.	New Orleans	June 17	15-ton hand operated crane, and constructing of drainage canal	F. S. Shields, Sec.
Neb.	Norfolk	About June 25	Storm sewer; cost, $2,000	H. H. Tracy, City Engr.

WATER SUPPLY

Sask.	Estevan	8 p. m., May 9	Laying water main and constructing sewers	P. J. Stephans, Sec.-Treas.
La.	Hammond	2 p. m., May 9	Improvements to water system	City Comrs.
N. D.	Carrington	May 10	10,450 ft. 6-in. water meters and 17-in. fire hydrants	C. W. Heinmiller, City Engr.
Mich.	Flushing	May 10	Extending water system	L. Mann, City Clk.
S. D.	Madison	8 p.m., May 11	Constructing well	T. H. Waskey, Mayor.
Pa.	Lebanon	5 p.m., May 11	55,000 ft. vit. pipe sewers	T. R. Crowell, City Eng.
N. D.	Beach	8 p.m., May 11	Furnishing and erecting two standpipes	M. A. Eagan, City Auditor.
Wis.	Colfax	2 p.m., May 11	Water works system	C. A. Kinney, Vil. Clerk.
N. Y.	Cobleskill	May 11	Filter house, piping and appurtenances	Bd. Water Comrs.
Wash.	Cashmere	May 11	Furnishing centrifugal pump	Town Clerk.
Ill.	Joliet	10 a.m., May 11	Water mains in various streets	A. M. Barry, Clerk.
Pa.	Harrisburg	3 p.m., May 11	Furnishing water meters for the year	R. F. Bowman, Supt. Safety.
Ill.	Moline	10 a.m., May 12	Constructing water mains	M. R. Carlson, Pres.
Ill.	Chicago	May 12	Erecting two steam turbine driven centrifugal pumps	L. E. McGann, Comr. Pub. Ser.
N. Y.	New York	May 12	Constructing part of Richmond conduit	Board Water Supply.
N. J.	Belleville	May 12	Laying c.-i. pipe, valves, etc	E. E. Mathes, Town Clerk.
Mont.	Glasgow	8 p.m., May 13	Constructing water main	E. E. Crawford, City Clerk.
Sask.	Kansack	May 13	Installation of water works system	A. A. Crawford, Sec.-Treas.
Tex.	Galveston	noon, May 14	Digging two wells	J. D. Kelly, City Secy.
Pa.	Clearfield	Noon, May 14	Spillway and core wall for reservoir	Clearfield Water Co.
Pa.	Philadelphia	Noon, May 15	Water supply in connection with park	L. M. Cooke, Dir. P. Safety.
Mo.	Dexter	8 p.m., May 18	Water works system, including well, pumping station, tower, etc.	J. I. Moore, City Clk.
Ia.	Mt. Pleasant	3 p.m., May 19	Reinforced concrete reservoir, 200,000 gal. capacity; also steam fire pump	W. D. Worthington, City Clk.
Mo.	St. Louis	Noon, May 19	Furnishing and installing three wash water pumps, two pressure pumps, two chemical solution pumps with motors, controlling apparatus and all appurtenances; also pipe and special castings	E. R. Kinsey, Pres. Bd. Pub. Imps.
Mass.	Boston	May 22	12, 6 and 20-inch water pipe	L. K. Rourke, Comr.
S. D.	Madison	May 23	30 ft. diameter well	C. A. Trimmer, City Engr.
H. T.	Pearl Harbor	10 a.m., June 2	Cast-iron pipe, galv. pipe, fire hydrants, manhole frames and covers, etc	Navy Dept., Washington, D. C.
N. Y.	Sidney	about July 1	Constructing water works, cost $125,000	Village Clerk.

LIGHTING AND POWER

Wash.	Okemogen	2 p. m., May 11	Furnishing electrical apparatus for project	O. H. Ensign, Engr., Los Angeles, Cal.
Mont.	Lewistown	8 p.m., May 11	Installing street lighting system	H. L. Fitton, City Clk.
Mich.	Ionia	May 12	Electric wiring in building	E. A. Boyd, Lansing.
O.	London	Noon, May 12	Equipment for cluster lights	J. W. Byers, Village Clk.
Neb.	Bruning	May 12	Constructing electric light system, $7,308; also water system, cost $11,778	Village Clerk.
N. Y.	Brooklyn	10 a.m., May 12	Metallic copper hose, steel forgings, etc	Navy Dept., Wash. D. C.
W. Va.	Wheeling	May 13	Power house and machinery for dam	Maj. J. P. Jervey, Corps. Engrs., U. S. Army.
Mont.	Glasgow	8 p.m., May 13	Street lighting system	E. E. Crawford, City Clerk.
Minn.	Chisholm	5 p.m., May 13	216 100-watt, 220 volt Tungsten lamps	H. A. O'Brien.
Ill.	Chicago	11 a.m., May 14	Furnishing 1,000 ornamental incandescent gas mantel lamps	R. Farmer, Comr. Gas & Elec.
Ill.	Sterling	May 15	Installing ornamental street lighting system, cost $9,015	A. J. Platt, Chr. Lt. Com.
O.	Cleveland	Noon, May 15	Weather proof copper wire	A. R. Callow, Comr. Pur. & S.
Ind.	Fort Wayne	noon, May 16	Constructing addition to municipal light plant	Board of Public Works.
N. D.	Mayville	noon, May 29	Rewiring school building	T. A. Hillyer, Pres.

FIRE EQUIPMENT

S. D.	Yankton	8 p.m., May 11	One motor-driven combination hose, ladders and chemical	D. M. Doile, Chr. Jt. Com.
Ala.	New Decatur	May 11	Furnishing combination chemical and hose	City Clerk.

BIDS ASKED FOR

STATE	CITY	REC'D UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
N. J.,	Jersey City	May 11	10,000 ft. cotton rubber-lined fire hose	M. I. Fagen, City Clerk.
Iowa,	Clinton	May 12	Furnishing tractor for ladder truck	S. W. Leedham, City Clerk.
Ill.,	Moline	10 a.m., May 15	Two or three motor-driven noiseless cars; one combination pumping engine and hose car; one motor-driven runabout; one 75-ft. aerial truck; 15 fire alarm boxes	C. V. Johnson.
BRIDGES				
N. D.,	Forman	2 p.m., May 12	Building county bridges for year	D. K. McPherson, Auditor.
Md.,	Baltimore	noon, May 12	Constructing reinforced concrete bridge	O. E. Weller, Chm. State Rds. Comn.
Tenn.,	Nashville	2 p. m., May 12	Reinforced concrete bridge	Mayor.
Ind.,	Marion	10 a.m., May 13	Constructing several bridges	Co. Comrs.
Wis.,	Green Bay	10 a. m., May 14	Constructing culverts and grading	City Clerk.
Ohio,	Troy	10 a.m., May 15	Constructing reinforced concrete bridge	M. T. Staley, Co. Aud.
Ind.,	Greencastle	May 16	Two reinforced concrete bridges	Co. Comr.
Minn.,	Ada	May 19	Constructing two bridges	County Board Contract.
O.,	Tiffin	May 23	Three concrete arch bridges	County Comrs.
Ind.,	Kokomo	10 a.m., May 23	Four bridges	County Comrs.
Minn.,	Crookston	3 p.m., May 25	Constructing reinforced concrete culverts	H. J. Welte.
Ind.,	Indianapolis	May 27	Constructing bridge	Comr.
Mont.,	Butte	10 a.m., May 29	Constructing concrete or steel bridge	Bd. Co. Comrs.
N. Y.,	Charlotte	June 4	Constructing bridge, cost $75,000	Co. Comrs.
MISCELLANEOUS				
Ill.,	Chicago	11 a.m., May 9	7,000 cu. yds. crushed granite or trap rock	L. E. McGann, Comr. Pub. Ser.
Ill.,	Chicago	11 a.m., May 11	500 street sign posts on concrete foundations; also name plates	R. Palmer, Comr. Gas & Elec.
O.,	Cleveland	May 11	Retaining wall	Board Education.
Cal.,	Mare Island	10 a.m., May12	Supplying multiple leaders, tubes, boilers, etc	Navy Dept., Wash., D. C.
O.,	Akron	May 14	Garbage reduction equipment	Director Public Service.
Ill.,	Chicago	11 a.m., May 14	Furnishing and erecting two 300-Hp. water tube boilers; furnishing 20 tons lead pipe, various sizes	L. E. McGann, Comr. Pub. Ser.
Md.,	Baltimore	2 p.m., May 16	Two fog signal units, consisting of oil engine and air-compressor	Light House Inspector.
Ill.,	Chicago	May 20	Furnishing motorcycle	J. F. Neil, Secy.
Conn.,	Waterbury	4.30 p.m., May 29	Constructing municipal building	City Hall Comn.
N. C.,	Rocky Mount	3 p.m., May 29	Constructing complete post office	Supv. Arch., Wash., D. C.
N. Y.,	New York	11 a. m., June 2	Constructing 9 concrete, stone and brick superstructures	Comr. Water Supply.

STREETS AND ROADS

Gadsden, Ala.—Council has passed ordinance providing for election to be held June 1 on question of issuing $100,000 for street improvements.

Union Springs, Ala.—Extensive improvements are to be made on streets and sidewalks of Union Springs at early date.

Marysville, Cal.—W. G. Robson, of Nevada County, has asked the co-operation of Supervisors of Yuba and Nevada Counties to end that Nevada City-Marysville lateral be built in connection with State highway.

Placerville, Cal.—Bids for completion of state highway between this place and Folsom are considered exorbitant by the Commission, lowest bid being for $59,000, submitted by Burke, Lyon & Hughes, of Placerville. While total estimate of engineer called for but $50,000, road is to be completed under day labor system. This will be done under direct supervision of Commission.

Sacramento, Cal.—Purchase of $150,000 of state highway bonds to be used in building state highway in Kern County has been arranged with State Treasurer Roberts by officials of Kern County. Actual sale will be consummated within few days.

San Francisco, Cal.—Board of Works has directed City Engineer to prepare specifications for paving and improving Geary St., between First and 48th Aves., where necessary work has not already been done, and also Point Lobos Ave., from 40th Ave. to Great Highway, as requested by Sutro Heights Land Co. and Lyon & Hoag.

Pomona, Cal.—City Engineer C. E. Bayley has been instructed to prepare resolutions for work to be done on North and South Garey Aves., Lordsburg Rd. and San Antonio Ave.

Quincy, Cal.—A recommendation that a monster petition be presented to Governor Hiram W. Johnson and State Highway Commission asking that $250,000 be appropriated for construction of road along route of old Utah Construction Company's road up Feather River Canyon has been made.

East Hartford, Conn.—Selectmen are planning to macadamize number of streets in town. Brewer St. is to be done first, from South Main St. to Forbes St., a distance of 1¼ miles. This is to be done before July 1. Later work on Silver St. will be taken up.

Boulder, Colo.—City Council has approved plans and specifications for paving of Pearl St. in front of court house square with concrete pavement and Tarvia "A," with vitrified brick between Denver & Interurban tracks.

Denver, Colo.—Park Board has ordered improvement work begun on Morrison road of mountain park system. Road is a little more than 12 miles in length and connects with Alameda Ave. at county line. It is southwest highway that will connect Denver with parks in mountains. For work there is available $26,000. Of this sum the Denver Park Commission has appropriated $16,000, Jefferson County Commissioners $8,000, and the State Highway Commission $2,000. Frederick Steinhauer, Denver park superintendent, and Frank Morris of Jefferson County will have charge of operations.

Jacksonville, Fla.—Memorandum of proposed system of good roads for Duval County, together with map of same, has been filed with good roads committee of Jacksonville Board of Trade by County Engineer A. F. Harley. Memorandum is as follows: Mayport road, unpaved 0.6 miles, 6,300 sq. yds., $7,950; Camp site road, 1.1 miles, 9,217 sq. yds., $13,975; John Anderson, paved with shell 0.6 miles, 7,604 sq. yds., $11,406; John Anderson, paved with shell 7.1 miles, 62,133 sq. yds., $93,199; John Anderson, unpaved 4.1 miles, 36,557 sq. yds., $54,865; Atlantic Blvd., paved with shell 0.5 miles, 6,471 sq. yds., $9,706; Atlantic Blvd., paved with shell 2.4 miles, 28,800 sq. yds., $43,200; Atlantic Blvd., paved with shell 1.3 miles, 16,116 sq. yds., $24,174; Atlantic Blvd., paved with shell 2.6 miles, 30,222 sq. yds., $45,333; National highway, unpaved 15.8 miles, 138,915 sq. yds., $208,372; Kings road, paved with shell 1.4 miles, 17,038 sq. yds., $25,557; Kings road, paved with shell 2.0 miles, 17,952 sq. yds., $26,928; Kings road unpaved 4.0 miles, 35,200 sq. yds., $52,800; Lem Turner road, paved with shell 3.6 miles, 31,542 sq. yds., $47,313; Lem Turner road, unpaved 4.6 miles, 24,100 sq. yds., $36,600; 21st St., paved with shell 1.8 miles, 32,573 sq. yds., $48,859; 21st St., unpaved 0.8 miles, 10,840 sq. yds., $16,260; West Dunn Ave., unpaved 4.5 miles, 39,333 sq. yds., $59,000; Lackawanna Ave., unpaved 4.5 miles, 39,667 sq. yds., $59,500; 102d St., paved with shell 3.6 miles, 31,667 sq. yds., $47,500; Orange Park road, paved with shell 3.7 miles, 32,283 sq. yds., $48,425; 28th St., paved with shell 0.5 miles, 6,067 sq. yds., $9,100; Moncrief road, paved with shell 3.1 miles, 27,417 sq. yds., $41,125; Fisher St., unpaved 0.7 miles, 8,738 sq. yds., $13,107; Evergreen Ave., paved with shell 0.9 miles, 13,536 sq. yds., $20,304; Main St., paved with shell 1.4 miles, 16,116 sq. yds., $24,174; Moncrief Ave., unpaved (except ½ mile) 2.5 miles, 22,000 sq. yds., $33,000; Tallevrand Ave., paved with shell 1.9 miles, 26,944 sq. yds., $40,416; Loretta, unpaved 2.9 miles, 26,177 sq. yds., $39,265; Chaseville road, unpaved 5.0 miles, 44,000 sq. yds., $66,000; 33d St., unpaved 0.5 mile, 4,400 sq. yds., $6,600; Edgewood Ave., unpaved 3.6 miles, 32,183 sq. yds., $48,275; Post St., unpaved 0.4 mile, 3,540 sq. yds., $5,310; Roselle St., unpaved 0.7 mile, 6,667 sq. yds., $10,000; Day Ave., unpaved 1.4 miles, 12,133 sq. yds., $18,200; Clyde St., unpaved 2.9 miles, 25,333 sq. yds., $38,000; 26th St., unpaved 0.9 mile, 8,633 sq. yds., $18,950; Nelson Ave., unpaved 2.0 miles, 17,600 sq. yds., $26,400; Warrington Ave., unpaved 0.5 mile, 4,400 sq. yds., $6,600; Second circle, unpaved 7.0 miles, 36,960 sq. yds., $55,440; East Dunn Ave., unpaved 4.5 miles, 39,600 sq. yds., $59,400; Flynn Ave., unpaved 1.2 miles, 10,467 sq. yds., $15,700; Pearl St., unpaved 1.9 miles, 16,653 sq. yds., $24,979.

Atlanta, Ga.—Movement is under way to create thoroughfare 100 ft. wide on Peachtree Battle Ave., center of it to be parked all way from Peachtree road to Howell mill road, parking to be along strip of about 25 ft. wide in center of avenue, allowing driveway of 30 ft. on each side of parked strip, and sidewalk of 7½ ft. on each side of roadway.

Atlanta, Ga.—Mayor Woodward has approved resolution passed by Council authorizing work to proceed on regrading and widening of South Pryor St., from Georgia Ave. to Southern railroad. Apportionment sheet carries appropriation of $15,000 with which to do work, and county will furnish labor and equipment equivalent to $10,000, making improvement worth $25,000 when finished.

Cairo, Ill.—City contemplates paving streets between 21st and 28th west of Washington Ave., and same streets east of Washington Ave.

Elgin, Ill.—Bids will be received on May 12 for construction of 10,696 sq. yds. brick and 20,748 sq. yds. asphaltic concrete. M. H. Brightman is engineer and W. F. Sylla is city clerk. Bids will also be received about June 15 for 30,033 sq. yds. asphaltic concrete.

Springfield, Ill.—Notices have been sent out by Superintendent of Special Assessments Schnepp for meeting to consider paving of Monroe St., from 15th St. to East Grand Ave. Other paving which is now under way or for which contracts are to be let includes Adams, between 7th and 10th Sts.: Cedar, from 2d St. to Hawthorne Pl.; Mason, from 2d to Walnut St.; Pasfield, from Lawrence Ave. to Allen St.; Ash, from 6th to 15th St.; S. 11th, from S. Grand Ave. to Ash St., and Rutledge, from Calhoun to N. Grand Ave.

Quincy, Ill.—Bids will be received on May 2 by Board of Local Improvements for excavating, curbing, grading, improving and paving with concrete base and bituminous wearing surface of Hampshire St.

Waukegan, Ill.—Paving of Washington St. with brick upon concrete base has been ordered.

Indianapolis, Ind.—Bids have been opened by Board of Park Commissioners for paving with asphaltic concrete 38th St., from Capitol Ave. to Fall Creek. Bids were taken under advisement. They ranged from $103,850 to $112,844. Board's original estimate of the cost of work was about $120,000.

Kokomo, Ind.—Notice is given that sealed bids will be received at office of County Treasurer of Howard County, Indiana in Court House in city of Kokomo, Ind., up to the hour of 10 o'clock a. m., May 7, 1914, for purchase of series of free gravel road bonds in sum of $145,900. Larry Ryan is Treasurer.

South Bend, Ind.—Board of Works has opened bids for paving of Pennsylvania Ave. and referred them to engineer for tabulation. Petition was filed for opening of South Scott St. north to Colfax Ave.

South Bend, Ind.—Contract for paving of St. Louis St., from South Bend Ave. to Corby St., has been let by Board of Works to Rankert & Eggleston.

Muscatine, Ia.—City Engineer has been instructed to prepare estimate of cost of grading Lombard St., south of Second, and also for cost of grading Seventh, between Lombard and Cypress Sts.

Bowling Green, Ky.—State Commissioner of Public Roads Robert C. Terrell and Mr. Boykin, engineer of the Federal Roads Department at Washington, will be in city and county on Monday, May 4, for purpose of surveying dirt roads of county. Surveying will be undertaken at this time so that in event $300,000 road bond issue carries work can be started without delay.

Somerset, Ky.—Pulaski County will vote again on June 26 on proposition to issue $300,000 in bonds to build pikes.

Somerset, Ky.—Question of issuing $300,000 bonds for improving roads in Pulaski County has been defeated at election. Preparations are being made to call another.

Islip, L. I.—Bids will be received by Town Superintendent of Highways Cahill on May 19 for $17,000 worth of sidewalks to be laid in Sayville, West Sayville Bayport, Central Islip, Brentwood and West Islip. This money was voted at special election held last fall.

Bangor, Me.—Plans for state highway construction for coming season are assuming definite shape. Materials used will be about 93 miles gravel, 8 miles bituminous macadam, 15 miles macadam, 6 miles gravel or macadam, 11 miles gravel or sand clay, 2 miles concrete. Besides state highway work which will amount to about 125, it is expected that Commission will supervise construction of 125 miles more of state aid highways.

Hagerstown, Md.—County Surveyor E. R. Darby, who was recently appointed county superintendent of roads under new local road-making law, will build about 16 miles of road in Washington County this year at approximate cost of $30,000.

Boston, Mass.—Boston's first paving work of year will be of granite on that portion of Massachusetts Ave., from railroad bridge to Columbia road, and it will cost city $10,500, or $3.10 per sq. yd., instead of $3.60 per sq. yd. customary price for last year. Commissioner Rourke has also been instructed to advertise for paving of Atkinson St., in same locality.

Haverhill, Mass.—Alderman Wood has presented order for authorization of sale of city bonds of $27,000 at rate of 4 per cent., the proceeds to be devoted as follows: Sewer construction, $5,000; street construction, $8,000; schoolhouse construction, $8,000, and contagious hospital, $6,000. Order authorizing sale of city bonds of $4,000 at 4 per cent. has been introduced by Alderman Wood, proceeds to be used for sidewalk construction. Orders were passed authorizing block-paving of Water St., from Main to Came Ave., at cost of $3,275; setting of edgestones where necessary and replacing of sidewalks on Water St., at cost of $2,380; granite block paving of Essex St., from Washington Square to High St., at cost of $4,600, and edgestone and sidewalk work necessary at cost of $1,500.

Lawrence, Mass.—Council will consider paving of number of streets with blocks at cost of about $155,000.

Lawrence, Mass.—Alderman Hannagan has asked for paving loan of $300,000 at regular session of Municipal Council to carry on block paving this year. Streets which he proposes to block pave and estimated cost of same follow: Loring street, $23,290; Osgood St., from Market to Merrimack, $6,620; Shattuck St., $7,470; Newton, from Shattuck to Andover, $34,420; Andover, from Newton to Beacon, $21,790; Avon, from Jackson to Hampshire, $16,400; Elm, from Jackson to Short, $8,230; Elm, from Lawrence to Hampshire, $16,400; Pine, $1,850; Berkeley, from Knox to Jackson, $13,360; West, from Manchester to the end of the paving, $21,930; Acton, from Broadway to West, $4,800; Manchester, from Broadway to May, $17,900; Park, from Lawrence to Monmouth, $7,290; Andover, from Parker to South Broadway, $15,870; Haverhill, from Milton St. on the south side to the Methusen line, including a new sewer, $8,160; Appleton St., from Common to Methuen, $6,209, and West St., from Haverhill to Bradford, $3,090.

Lawrence, Mass.—City Council voted four to one to spend $250,000 for granite block paving on 20 different streets this year in nearly every ward in city. Streets and appropriations for each are as folloys: Union from Essex to Haverhill, $15,500; Acton from Broadway to West, $4,800; Avon from Jackson to East Haverhill, $3,620; Lowell from Broadway to the railroad bridge, $4,580; Manchester from Broadway to May, $17,900; Elm from Lawrence to Hampshire, $16,400; Oxford from Essex to Medford, $6,000; Park from Lawrence to Monmouth, $7,290; Pine from Elm to Hampshire, $1,850; Haverhill from Milton to the Methuen line, $8,160; Berkeley from Knox to Jackson, $13,600; Elm from Jackson to Short St., $8,230; West from Manchester southerly, $21,930; West from Haverhill to Bradford St., $3,090; Andover from Parker to South Broadway, $15,870; Andover from Newton to Beacon, $22,790; Loring from Market to the Shawshin bridge, $23,290; Market from Loring to Osgood, $4,520; Newton from Shattuck to Andover, $34,420; Osgood from Market to Merrimac, $6,620; Shattuck from So. Broadway to Newton, $7,240.

Salem, Mass.—County Commissioners, town of Peabody and State Highway Commission have agreed to reconstruct highway betwen Salem and Danvers line this summer.

Taunton, Mass.—It has been voted to recommend appropriation of $31,000 for permanent improvements of highways during present year. Of this, $10,000 is to be spent on Middleboro Ave., according to plans, for co-operative road building plan, approved by State Highway Commission.

Burr Oak, Mich.—Village is planning to pave about 2,100 sq. yds. probably with vitrified blocks. G. A. Eagleton is Surveyor.

Flint, Mich.—Resolutions authorizing issuance of bonds which were voted by taxpayers at elections last spring and at election this spring and providing for form of bonds have been introduced before Common Council by Alderman Kellar and adopted. Bonds to be issued are as follows: Street improvements (graveling), $22,478, bonds to expire beginning Aug. 1, 1915, and ending Aug. 1, 1919, one bond to be $478; four to be $500, and 20 to be $1,000 denominations. Street improvements (paving), $39,073.64, bonds to expire beginning Aug. 1, 1915, and ending Aug. 1, 1926, one bond to be $43.64, 12 to be $500 and 33 to be $1,000 nedominations. Sewer bonds, $153,000, bonds to expire Aug. 1, 1915, and ending Aug. 1, 1927, one bond to be $800 and 153 of $1,000 denominations. All bonds will bear interest at 4½% payable semi-annually.

Flint, Mich.—Expenditures approximating nearly $15,000 for gravel and washed concrete to use in building streets and new machines for doing street work have been authorized by Common Council and resolution favoring purchase of steam shovel for excavating work in streets, that will mean an additional $4,000 expenditure, has been adopted.

Flint, Mich.—City Clerk has been authorized to advertise for bids for grading of Warren, Dayton and Baker Sts., between Saginaw St. and Ave. A and Rankin St., between Saginaw St. and North St.

Flint, Mich.—Petitions for paving of Brush St., from Union to Water St., and of Water St., from Brush to Saginaw St., have been presented.

Grand Rapids, Mich.—Survey of Grand Rapids street paving system and several propositions for better street paving are under consideration by paving committee of Association of Commerce.

Saginaw, Mich.—City contemplates in near future to pave following streets at given estimated costs: Holland Ave., Warren to Genessee, $16,950; Franklin St., Tuscola to Genessee, $4,163; Park St., Remington to Holland, $3,720; Brewster St., Michigan to Fayete, $1,956; Congress St., Michigan Ave. to the Michigan Central Railroad tracks $1,661.

Sturgis, Mich.—City will vote on proposition early in June on paving 5,000 sq. yds. Kind of paving material to be determined shortly.

Grand Marais, Minn.—Bids for construction of two miles of Lake Shore road at west end of Cook County have been opened by County Board. There were only two bidders, William C. Smith, of Schroeder, and J. D. O'Connell, of Duluth. Bids were so largely in excess of estimate of engineer that both were rejected, and it was decided to do work by day labor.

St. Paul, Minn.—Board of Public Work has adopted favorable reports on orders to grade Palace St., from Fairview to Underwood; Sargent St., from Syndicate to Griggs, and Jefferson, from Fairview to Underwood.

St. Paul, Minn.—Problem of paving Concord St. from downtown South St. Paul to Annapolis St. in St. Paul, a distance of two miles, is being discussed.

Clarksdale, Miss.—Sum of $100,000 will be spent on road improvements by Bd. County Supervisors.

Kahoka, Mo.—Election may be called for May 12 for voting on $4,000 bond issue for street improvements.

St. Joseph, Mo.—Plans have been made for pushing work on Noyes Boulevard and Boulevard A by Park Board.

St. Joseph, Mo.—Board of Public Works has planned to improve Pacific St. by paving with asphaltic concrete, and to improve various other streets by constructing new concrete curbs, laying concrete sidewalks and grading and paving alleys. F. W. Lander is Clerk.

St. Joseph, Mo.—Bids are being received for paving with Mineral Rubber Asphalt, Ohio St., from King Hill to Lake Ave., and constructing curbing and sidewalks there along. Chas. Nowland is Pres.; Fred. W. Lauder, Clerk, Board of Public Works.

St. Louis, Mo.—Ordinances have been adopted for improvement of various streets and alleys.

York, Neb.—Citizens have voted $25,000 bonds for paving. A. B. Chatterton is City Clerk.

Asbury Park, N. J.—City Council has decided to retop, with gravel, following streets: Summerfield, from Main to Emory; First, from Grand to Ocean; Sixth, from Main to Grand, and Munroe, from Main to Grand. Cost, it was estimated by Street Chairman Winckler, will be about $2,500. Mr. Winckler will probably recommend purchase of scarifier.

Camden, N. J.—Finance committee of City Council of city of Camden, N. J., will receive sealed proposals at 8 o'clock p. m., April 27, 1914, for purchase of $125,000 paving bonds. Geo. A. Freey is City Treasurer.

East Orange, N. J.—Franklin St., Long St. and Schuyler Terrace will be paved.

Elizabeth, N. J.—Ordinances have been adopted for improvement of various streets.

Elizabeth, N. J.—County road committee of Board of Freeholders has pledged $15,000 from motor vehicle fund. This sum will be used in paving Westfield Ave. from this city to Chestnut St., Roselle Park. Work will be put under way as soon as the law can be complied with on advertisements for bids and contract awarded.

Garfield, N. J.—Permanent road improvements are advocated.

Passaic, N. J.—City Commissioners have been assured by Board of Freeholders that Erie St. and Franklin Ave. would be permanently improved this summer.

Plainfield, N. J.—Paving of W. Third St. has been petitioned for.

Trenton, N. J.—City Commission has authorized City Treasurer Evans to readvertise $150,000 street improvement bond issue and to sell issue as whole or in lots of $1,000. Bids will be opened May 7.

Trenton, N. J.—Bonds will be sold on May 7 in sum of $150,000 for street improvements. H. E. Evans is City Treasurer.

Westfield, N. J.—Town Plan and Art Commission has completed plans for improvement of Pleasant Place and opening of that street through to Dudley Ave. at meeting of Commission. This will be first improvement which commission will recommend to Town Council. Improvement will call for street 66 ft. wide, with sidewalks.

Albany, N. Y.—Five million dollars of second $50,000,000 highway bond issue became available immediately and like amount for road improvement will become available Oct. 1, under terms of Frawley bill which Gov. Glynn signed.

Binghamton, N. Y.—Ordinance authorizing sale of $25,000 worth of paving

bonds will come up on second reading and be adopted.

Ithaca, N. Y.—Specifications for concrete highway 16 ft. in width, between Newfield and Cayuta, distance of about eight miles, are now on file at office of Highway Superintendent at Albany, and it is probable that bids will be advertised for within short time.

Ithaca, N. Y.—Board has decided that any paving which is to be done on Deyden Road this year will be of concrete construction.

Ithaca, N. Y.—Plans have been made to pave North Tioga St.

Middletown, N. Y.—Petition has been received from 27 of residents of Liberty St. by Common Council, asking that that street be repaired with crushed stone and Tarvia. Request was received and filed.

Plattsburg, N. Y.—Special election will be held on May 21 for voting on question of issuing bonds for various street improvements.

Niagara Falls, N. Y.—Common Council has adopted resolution to order paving or macadamizing of Tenth St., from Lockport St. to North Ave., 30.84 ft. in width, including curbs, at estimated maximum cost of $26,850 if granite or wood block is used; $21,750 if asphalt block is used; $20,450 if asphalt, bitulithic, brick or asphaltic concrete is used; and $17,250 if Hassam is used, in accordance with plans prepared by City Engineer and on file in his office. T. H. Hogan is City Clerk.

Rochester, N. Y.—Brick has been specified as material for paving following streets: Carl, Herald, Dudley, Maria and Hixson.

Rochester, N. Y.—Ordinances have been adopted for improvement of various streets.

Utica, N. Y.—Ordinances have been adopted for paving of six streets and for resurfacing ten.

Columbus, O.—Contracts are to be let in May for rebuilding old national highway each from Columbus, capitol of Ohio, to Pennsylvania state line at Wheeling, according to announcement by State Highway Commissioner James R. Marker. Distance is 125 miles.

Defiance, O.—Bids will be received for purchase of $31,000 road bonds until May 4. Rogers Daoust is Co. Aud.

Dover, O.—Bids will be received for purchase of $2,000 grading, draining bonds until May 12. Clifford Pease is clerk.

Elyria, O.—Final legislation has been passed for paving W. River, Blaine and 11th Sts. and Second St. alley. It was also decided to macadamize Adams, Maple and Elm Sts.

Findlay, O.—Bids will be received for purchase of $8,500 Benner stone road bonds until May. 6. N. Traxler is Aud.

Franklin, O.—Six miles of road will be piked in Franklin Township.

Geneva, O.—Resolution has been adopted to improve Depot St., from N. Broadway west about 519 ft. A. J. Trunkey is Mayor and W. E. Morgan, Clerk.

Marion, O.—Paving of Main St. with brick is proposed. Estimated cost, $27,000.

Newark, O.—Ordinance has been passed for improvement of Central Ave.

Newark, O.—Resolution has been passed for construction of large number of sidewalks.

Sandusky, O.—City Engr. Wagar has estimated cost of paving Adams St. at $17,500; Wayne St., $14,000; Railroad St., $15,310.

Tiffin, O.—Ordinance has been adopted to proceed with improvement of Jackson St., from north line of West Perry St. to south line of Clay St., by paving with vitrified block upon crushed stone and gravel foundation or with asphalt block upon concrete foundation with necessary grading and curbing; also ordinances for similar improvement of other streets.

Astoria, Ore.—City Council has adopted 16 resolutions to improve all streets in reclamation district by filling to established grade, fill to be held by concrete retaining walls on both curb lines of street. This is one-half district that will ultimately be made permanent.

Carlton, Ore.—At meeting of City Council resolution calling for about mile of paving in city was passed. Main St. will be paved full width and in residence district it will vary from 24 to 35 ft.

Chester, Pa.—Clifton Heights is considering improving about 8 miles of streets at cost of about $45,000 to $50,000.

Ellwood City, Pa.—Bond issue of $20,000 has been voted for street and sewer improvement.

Erie, Pa.—Street improvements to extent of $26,100 have been authorized by Council. Of that amount, city will pay $5,100, remainder to be paid by the taxpayers. Following street improvement ordinances were introduced by Director Eichhorn and passed: Grading, draining, curbing and paving of Wallace St., from Second to Fifth St. An appropriation of $8,900 was made, $7,200 to be taken from the assessments and $1,700 to be paid by the city. Grading, draining and paving of Washington Place, from Eighth to Eleventh Sts., the cost to be $7,200, of which the city will pay $1,350 and the taxpayers the remainder, $5,850. Grading, draining, curbing and paving of Cranberry St., from Eighth to Eleventh St. The appropriation will be $8,500, of which the city will pay $1,750 and the remainder, $6,750, will be paid by the assessments. Grading, draining and curbing of Third St., from Parade to Ash St., the cost to be $1,500, of which the city will pay $300.

Hanover, Pa.—Ordinance has been adopted for paving, grading and curbing of Abbottstown St.

Kennett Square, Pa.—Estimated cost of 2¾ miles stone road from Kennett Square to Delaware State line is $60,000.

New Castle, Pa.—Among many other improvements of year, Council proposes to pave South St., from Mill St. to Apple alley, at cost of $4,200; E. Washington St., from Arlington Ave. to city line, at cost of $18,480; County Line St., from E. Washington to Produce, at cost of $1,300, and Marshall St., from E. Washington to Stanton Ave., at cost of $4,300. Various other streets will also be graded.

Scalp Level, Pa.—About 2,080 sq. yds. of street paving will be constructed. O. P. Thomas is Borough Engineer.

York, Pa.—Construction of three miles of paving is being planned by city.

Providence, R. I.—An act authorizing city of Providence to hire sum of $500,000 for paving streets in said city has been passed.

Grafton, R. I.—At special town meeting it was voted to appropriate $3,000 for continuance of state road from Grafton to Northbridge. To this $3,000 state will add $10,000. Town expects to raise its share of sum by issue of 4 per cent. bonds and to contribute in instalments of $600.

Woonsocket, R. I.—The joint standing committee on finance of City Council has recommended passage of resolution appropriating $55,000 for paving and building of surface water drain on North Main St., from in front of Park theatre to northerly line of Winter St., and for paving of Winter St., from North Main St. to railroad crossing.

Bristol, Tenn.—A third road bond issue will be sold May 1 by Sullivan County Road Commission for purpose of completing new system of macadamized roads.

Humboldt, Tenn.—Gibson County Court has voted appropriation of $10,000 to be used in constructing two roads across the county—one leading from Humboldt to Kenton and the other from Milan to Eaton.

Corpus Christi, Tex.—Corpus Christi has voted additional $50,000 bond issue to complete city's big paving program.

Denton, Tex.—The $300,000 road bond issue in road precinct No. 2 has fallen short of required two-thirds majority. Petition for another election, it is announced will shortly be in circulation.

Fort Worth, Tex.—County Commissioners have instructed Auditor to advertise for bids for building two miles of Grapevine road in precinct No. 4, 1¼ miles of the T. C. U. road in precinct No. 1 and for graveling 1 mile of Arkansas Lane. Engineer was instructed to prepare plans and specifications for building 2 miles of Bedford and McKinney road.

Fort Worth, Tex.—County Auditor has been instructed by Commissioners to advertise for bids for constructing 4½ miles of Haslet Rd., at cost of about $18,000, according to plans and specifications prepared by Engineer Travilla.

San Antonio, Tex.—Bidding on next batch of street paving to be ordered by City Council will be open to all and bids for all kinds of materials will be considered.

San Antonio, Tex.—County Commissioners ordered the County Auditor to advertise for bids on repairing two roads. They are Neal road for distance of four miles, grading and relaying; Pleasanton road, reshaping and claying for distance of three miles. Bids are to be made according to plans and specifications now on file with county highway engineer. Commissioners also ordered purchase of second-hand road grader from J. L. Burd at a price of $225.

Temple, Texas.—County Commissioners' Court has sold $600,000 in good roads bonds recently voted in Temple precinct to Harris Trust & Savings Bank at Chicago for par and accrued interest.

Logan, Utah.—City Commissioners have passed resolution creating two street paving districts comprising 13 blocks. No protest was received in district No. 1. This is first street paving to be done in Logan. Districts include the streets from First South to Second North on Main St.; Second East to the depot on Center St.; First East to First West on First North. This takes in practically all business districts of city. From estimates given out by city engineer, it will cost approximately $70,000. On Main St. paving will cover the entire street. On other streets 16-ft. drive will be constructed on each side of street. City recorder has been authorized to advertise for bids.

Janesville, Wis.—City Clerk has been ordered to advertise for bids on contracts for construction of sidewalks by city during year.

Superior, Wis.—Plans and Specifications for paving of Iowa Ave., from Belknap St., to 21st St. are being prepared at office of City Engineer. Plans as drawn provide for pavement 30 ft. in width from Belknap to 18th St. From 18th St. to 21st St., the width is fixed at 34 ft.. Rock concrete will be used in paving street, that material having been selected by property owners.

CONTRACTS AWARDED.

Birmingham, Ala—By Board of City Comrs., to McCartin Constr. Co., Birmingham, for grading, macadamizing, combined curb and gutter and sidewalk paving on N. 26th St., at cost of $19,440; also to Dunn & Lallande Bros., Birmingham, for paving 22d St. with 3,700 sq. yds. Aztec asphalt paving $1.52 sq. yd.; cost $6,386.

Conway, Ark.—For paving with concrete streets Improv. Dist. No. 1 to F. U. Halter and R. B. McCulloch, at about $20,096.

Calexico, Cal.—To Imperial Valley Construction Co., of Holtville, Cal., at $75,981 for improving of certain streets in southern district of Calexico, including 1,287,981 sq. ft. of grading, 37,267 lin. ft. of cement curb, 177,754 sq. ft. of sidewalk, 19,720 sq. ft. of crosswalks, etc.

Sacramento, Cal.—Nine contracts calling for construction of 53.6 miles of State highway to cost $374,828, have been awarded by Advisory Board of State Department of Engineering. Contract was awarded to John W. McDonald, of San Jose, for laying an asphalt surface on State highway between San Jose and Mulia. McDonald's bid was $15,869. Berry Mackie & Co. of San Francisco, 4.5 miles of cement concrete highway, Humboldt County, $45,097. A contract for 12.4 miles of cement concrete work from Dearborn to the north county boundary line of Kern County was awarded to Lynn S. Atkinson of Los Angeles for $48,110. In Alemada County Tieslau Brothers of San Francisco were awarded the contract for building the highway from Hayward to Villa Vista schoolhouse for $19,538. A scond Alameda County contract calling for 5.1 miles of asphalt work from Oakland to Hayward went to the Ransome-Crummey Company of Oakland with a bid of $53,263. Hard Brothers of Sacramento were awarded a contract at $51,381 to grade 6.5 miles of highway from Forsythe Creek to Ridgewood, in Mendocino County. The San Diego County contracts were awarded as follows: Los Flores to Westerly County boundary, about 11.5 miles of Portland cement concrete, to W. A. Perry, Los Angeles, $69,935; from E. San Diego to La Mesa, about two miles of Portland concrete, C. L. Hyde Construction Company, San Diego, $11,742. The State highway between El Dorado and Placerville in El Dorado County will be let by the Highway Commission on the day-labor basis. Only two bids were received for this work and both were excessive.

Hartford, Conn.—Bids for laying of sidewalks have been opened and reported by Engineering Department to be as follows: Candee Stone Co., $8,364.25; H. E. Putnam, $8,639.75; A. S. Freeborg, $8,459.25. It was voted to award contract to Candee Stone Company, lowest bidder.

Hartford, Conn.—Contract for Aztec asphalt paving has been awarded to Edward Balf Company at $1.89 pr. sq. yd., or total of $54,381.60. Mr. Balf also submitted lowest figure for Bermudan asphalt at $56,280.50. Other bidders were Barker-Bonner Company, of New York, $69,287.30, and Union Paving Company, New York, $86,573.85.

Wallingford, Conn.—To Thomas Kearney, of Meriden, Conn., at $12,649, for construction of 11,877 sq. yds. of bitu-

minous-bound macadam and 5,166 sq. yds. of concrete pavement.

Wilmington, Del.—By Levy Court for construction of improved roads in New Castle County. Following were announced as successful bidders: Delaware City road, John A. Clark, $5,345; State road, John A. Clark, $14,460; Hockessin North Star road, Corkran Construction Co., $17,306.63; Clark's Corner to Bird's Corner, Alfred McDowell, $11,500; Milford-Newark road, John A. Clark, $16,400.

Fort Meade, Fla.—By Sidewalk Committee for construction of miles of cement sidewalks to C. M. Ward, of Pensacola. Price is 98 cts. per sq. yd.

Chicago, Ill.—By Board of Local Improvement, for constructing concrete curb, grading and paving with repressed vitrified brick on 2-in. sand and 6-in. Portland cement concrete various streets, to Peter J. O'Brien, Alex. N. Todd and Central Paving Co.

Glencoe, Ill.—To Wm. J. Walker, of Glencoe, at $9,238, for paving of Wentworth St., by Local Improvement Board.

Hillsboro, Ill.—For paving in District No. 1 to E. L. Curdie, Alton, at $40,796.

Murpheysboro, Ill.—For paving in Paving District No. 9, to Meyers-Thomas Construction Co., East St. Louis, at $78,-862.

Quincy, Ill.—For paving 12th St. to Roeder & Greenman, Quincy, at $36,872.

Fort Wayne, Ind.—By County Commissioners contract for building Maysville road, in Springfield Township, to John Zimmerman & Son, on bid of $23,386.40.

South Bend, Ind.—Contract for paving of Cedar St. has been awarded to Rankert & Eggleston by Board of Works. Bid submitted was $18,741.94.

Chariton, Ia.—For paving from plans of Iowa Engr. Co., Clinton, as follows: Division "A" awarded to J. W. Turner Improv. Co., Des Moines, 4,000 cu. yds. excav., 40 cts.; 24,400 lin. ft. curb and gutter, 53½ cts.; 6,500 lbs. cast and wrought iron, 3 cts.; 30,550 sq. yds. brick pavt., pitch filled, $2.04; total $77,171. Division "B" to H. J. Cathroe, Omaha, Neb., as follows: 2,000 cu. yds. excav., 40 cts.; 8,570 sq. yds. cement concrete pavt., $1.29; total, $11,855.

Clarinda, Ia.—To J. S. McLaughlin & Son, of Red Oak, Ia., at $54,162, for construction of 23 blocks of concrete paving, including 31,063 sq. yds. of paving, 22,-295 lin. ft. of curbing, and 4,544 yds of extra grading.

Tama, Ia.—For 14,500 sq. yds. brick pavement on 3d and 4th Sts. by City Council to Thos. Carey & Sons, Clinton, at $32,540.

Pittsburg, Kan.—Thoymartin & Gardiner, Fort Scott, were awarded five contracts for paving. S. A. Clements was awarded contract for paving Joplin Ave.

Louisville, Ky.—For paving, as follows: Deer Park Ave., to Bickel Asphalt Co., $9,000; Deerwood and Dearborn Aves. to Louisville Asphalt Co., at $19,000.

Donaldsonville, La.—To F. R. Rogers of Alexandria, La., for construction of 22 miles of gravel roads in First District of Ascension Parish, at $2,795 per mile. Contract provides for road surfaced with gravel for width of 15 ft., 5½ ins. deep in center and 3 ins. deep on each edge.

Shreveport, La.—To W. P. Ritchie & Co., Camden, Ark., contract at $30,000 for 5 miles gravel road beginning 10 miles north of Shreveport. W. E. Atkinson is State Highway Engr.

Hagerstown, Md.—Contract has been awarded by County Commissioners to Bester & Long, of Hagerstown, to construct mile of road from Spielman's Station to Fairplay for $1,785.

Hagerstown, Md.—To Chas. C. Dennis of Clearspring, contract for erection of two miles of road.

Rockville, Md.—By State Roads Commission, for road reconstruction from Darnestown to Dawsonville, this county, distance of 3½ miles, to Harper & Voght of Washington, for $35,700. Entire cost will be borne by state.

Boston, Mass.—Saving of several thousand dollars over cost of last year has been effected by highway department of Newton in awarding contract for supply of road surfacing oil and materials for 1914. Based on supply of 470,000 gallons, cost to city will be $31,240, while in 1913 it was about $35,000. Lowest bid for tar preparations to amount of 210,000 gallons has been submitted by American Tar Co., whose figures were $15,300. For asphaltic and non-asphaltic materials, Standard Oil Co. of New York submitted bid of $7,500 for 120,000 gallons. Contracts for smaller quantities of other oils will probably be given to this company.

Fall River, Mass.—For granolithic sidewalks, by city, to Beattie & Cornell, Fall River, at $1.38½ per sq. yd.; total about $32,000.

Newton, Mass.—Acting Street Commissioner George E. Stuart has awarded contract to Standard Oil Co., of New York, for 120,000 gallons of oils at about $7,500. American Tar Co. and the Barrett Mfg. Co. will furnish 210,000 each at $15,300.

New Bedford, Mass.—Contract for 10,-000 ft of curbing has been awarded to Riley & Denault and J. B. Sullivan & Son at 54 cts. and 55 cts. per ft., respectively.

Sangus, Mass.—By Board of Selectmen contract for oiling streets of town to Standard Oil Co.

Flint, Mich.—S. S. Saxton's bid for construction of asphalt pavement on West Fourth St. from Saginaw to Church St., at approximate cost of $4,500 has been accepted. Residents of street petition for pavement.

Flint, Mich.—Following contracts have been awarded: Road gravel, 10,000 cu. yds., at 83 cts. per ton net, Detroit and Oxford Gravel & Stone Co., approximate outlay, $11,205. Washed concrete, 2,500 cu. yds. at 30 cts. per ton with an addition of 60 cts. per ton for freight, Huron Shore Gravel Co., Saginaw, approximate outlay, $11,205. Two road scrapers, Gallion Iron Co., at $235 each less 5% if paid in 30 days, $446.50. Contract for all sandstone brick to be used in making of manholes for sewers to be constructed by city has been awarded to Flint Coal Co. on their bid of $9 per ton.

Grand Rapids, Minn.—For constructing 20 miles of Duluth St. Vincent road in Itasca County, to Louis Leimer, Colquit, at $32,019.

St. Paul, Minn.—Contracts for grading of Syndicate Ave., between Ashland and Selby Aves., and Buford Ave., between Como Ave. and Brompton St., have been awarded to Christ Johnson by Board of Public Works.

Columbia, Mo.—For road work, contracts were awarded as follows: To J. D. Lyon, Columbia, Providence Road, 2.2 miles macadam, $6,545; McBaine Road, 2.75 miles, Sexton Road, 3 miles, $5,875; graveling Clark Lane, 2½ miles, R. S. Jacobs, Columbia, $5,100. W. B. Cauthorn is Engr.

Manchester, N. H.—Contract for oiling street to American Car Sprinkler Co., of Worcester, Mass.

Garfield, N. J.—Contract for permanent improvement of Monroe St., with brick has been awarded to Union Building & Construction Co., of Passaic.

Long Branch, N. J.—At adjourned meeting of the West Long Branch Borough Council contract to grade Locust Ave., from Wall St. to Lippincott's Cor., a distance of one mile, was awarded to George A. Hulick, at $1,366.

Binghamton, N. Y.—For paving with bitulithic Prospect Ave., to Warren Bros., Boston, Mass., at $2.36 per sq. yd.

Burnsville, N. C.—To Yancey Construction Co., Inc., contract for road work in Yancey County, at cost of $150,000. Some of this contract will be sub-let.

Andover, O.—For paving Public Sq. and S. Main St. to Thomas Fitzgerald, Ashtabula, at $28,105.

Columbus, O.—Definite action in rebuilding old National road through Ohio started when the state highway department let contract for constructing 24 miles in Licking and Muskingum Counties to the H. E. Culbertson Co., of Cleveland. Company's bid, aggregating $436,-917 on separate jobs in two counties, was lowest of several competitive bids. Roadway will be made of concrete, 16 ft. wide, and will be the first extensive stretch of concrete road in the state. It will cost average of $16,000 a mile without bridges, or $18,000 with bridges. United States government will contribute $120,000 for construction of road in two counties. State will spend $80,000 and counties will pay balance of cost about $236,000. Work will be started immediately and probably will be finished by early fall. Bids were submitted on 14, 15 and 16-ft. roadway of concrete. Ten miles of road are in Muskingum County, extending from Zanesville to the Licking County line. Bid on this was $180,564. Remaining 14 miles are in Licking County, extending to point directly south of Newark. Bid on that was $255,553. Contract specifically calls for completion of work by Dec. 31.

Dayton, O.—Standard Oil Company has been awarded contract for supplying 150 tons of asphalt at cost of $18 per ton.

Delaware, O.—The Lake St. paving contract has been awarded by Board of Control to Lambert Bros. & Wirt. Railway portion of contract is to be constructed of Nelsonville block, and portion outside rails of Trimble block, same block used on North Washington and Griswold St. improvements. Bid of Lambert Bros. & Wirt for this combination totaled $27,131.19, and that of Wm. McHugh $27,139,58, so that Lambert Bros & Wirt were low bidders by close sum of $8.39.

Painesville, O.—For improving Lake-River Rd. in Madison Township and S. Ridge Rd., to Williams & Little Co., Cleveland, at $66,348 and to Lesher & Roses, Oil City, Penn., at $86,310 respectively. W. Albert Davis is Aud.

Tiffin, O.—The Hopeful Towwnship Trustees has awarded about seven miles of road improvement. There were numerous bidders and work was apportioned among five contractors. Price ranges from $1.24 to $1.79 per yd., which runs cost per mile from approximately $2,480 to $3,580. The contracts were awarded to lowest bidders as follows: Angling Flack Rd., C. D. Knepper, $1.74 per yd. One bidder. Hopewell church to Keppel's Cors., W. H. and H. A. Souders, of Fostoria, at $1.24 per yd. Two bidders. Road west from the corporation, Tiffin Lime & Stone Co., at $1.39. One bidder. Hopewell Center Rd., Souder Bros., at $1.38 per yd. Two bidders. Beech Grove Rd, Souder Bros., at $1.46 per yd. Two bidders. New Riegel Rd., Souder Bros., at $1.72 per yd. Three bidders. Inter-County Highway, Ecker & Bell, Fostoria, at $1.79 per yd. Five bidders.

Trimble, O.—For paving road, by County Comrs. at Athens, to Guy J. Pierce, Trimble, and B. F. Eddy, Athens, at $5,321.

Youngstown, O.—By Bd. of Control, for paving as follows: Chas. Harris, for Himrod Ave., $14,095; P. Mylott, for Haseltine, Rice Ave. and Halleck St., total, $15,076; Miller & Quinn, for Ayres St., $14,143; Miller Bros., for South Ave., $13,812.

Portland, Ore.—For constructing concrete curb, walks, etc., on Simpson and Jessup Sts., to M. Hansen, at $10,000.

Bradford, Pa.—For High St. paving contract was awarded to John Sheehan & Co., 41 Main St., as follows: 3,137 sq. yds. brick pavt., $2.05; 2,367 lin. ft. concrete curb and gutter, 75 cts.; total including excav, tile, etc., $11,396. B. A. Wise is City Engr.

Columbia, S. C.—Contract for about 60,000 sq. yds. of sheet asphalt on 5-in. concrete base, at $1.53 per sq. yd., and bituminous concrete "Y" on 5-in. concrete base at $1.55 per sq. yd., to R. M. Hudson, Atlanta, Ga. Grading included in price per sq. yd. J. McNeal is City Engineer.

Loudon, Tenn.—Contract for seven miles of government post road from here to Monroe County line has been awarded to R. B. Oliver, of Maryville. Road will be built under supervision of government engineers, and expenditure will be about $50,000. Road will be of uniform width of 14 ft., and drainage will be guttered all the way. All of macadam will be laid uniformly in thickness and size, and road will probably be best piece of road in state, costin gabout twice as much as ordinary pike roads.

London, Tenn.—For surfacing with waterbound macadam 7 miles of Tennessee Post Road, to R. B. Oliver, of Marysville.

Tyler, Tex.—By Comrs. of Tyler Good Roads Dist., for constructing 25 miles of sand-clay roads to Karner Bros. of Dallas, at $33,534.

Olympia, Wash.—State Highway Board has awarded two contracts for highway work, totaling approximately $55,000. C. H. Maginnis of Portland secured contract for clearing, grading and draining nearly four miles of Pacific highway, from Woodland to La Center, in Clarke County. O. F. Leonard of North Yakima secured contract for eight miles of Inland Empire highway, from Colfax to Steptoe, price being $28,686.

Green Bay, Wis.—To White Construction Co., Milwaukee, Wis., contract at $112,440, for paving various streets with asphalt.

Lake Geneva, Wis.—For cresote wood block pavements on Broad and Main Sts., to D. A. Thacher, Chicago, Ill., at $48,153.

Milwaukee, Wis.—For asphalt pavement as follows: Cramer Bremen, Achillas Sts. and Lake Drive, to F. P. Coughlin, Chicago, Ill., at $68,489; 44th, Galena, 54th, Vine, 51st, 52d, Center, 5th Sts., Louis, Pabst Aves. and Broadway, to Badger Constr. Co., 97 Wisconsin St., at $61,-000, and National Ave. and O'Dell St. to White Constr. Co., Milwaukee, at $12,500.

Racine, Wis.—Contract has been awarded to Western Improvement Co. for paving Thurston Ave. with sheet asphalt at $1.95 per sq. yd. for paving and 58 cts. per lin. ft. for combined curb and gutter. C. A. Ryba is City Clerk.

Racine, Wis.—For paving Barker St., from N. Michigan to Superior St., at

about $17,000, to Birdsall-Griffith Const. Co.

Superior, Wis.—To John Diffoe, contract for paving Cumming Ave. with crushed rock concrete.

London, Ont.—To Foley & Gleeson, of Ottawa, at $2.37 a sq. yd., for 8,000 sq. yds. of asphaltic concrete paving; also 2,740 sq. yds. of vitrified brick paving at $2.63 a sq. yd. Wm. Ashplant is City Engineer.

Stratford, Ont.—For 12,000 sq. yds. concrete base for pavements, 3,400 sq. yds. one course concrete pavt., and 12,650 lin. ft. concrete curb. Contract was awarded to John L. Youngs of Stratford.

SEWERAGE

Cairo, Ill.—City contemplates constructing sewers between 21st and 28th Sts., west of Washington Ave., and same streets east of Washington Ave.

Elgin, Ill.—Bids wil lbe received about June 15 on 36,000 ft. of 6-in. to 15-in. vitrified pipe sewers. M. H. Brightman is Engineer and W. F. Sylla is City Clerk.

La Salle, Ill.—Voters have decided in favor of $40,000 sewer bond issue.

Moline, Ill.—Bids will shortly be asked for laying of sewers and water mains in this city. Water main contract amounts to $109,000 and the sewer contract to $119,000.

Moline, Ill.—Bids will be received on May 12 for constructing sewers and sewage treatment plant in East End Sewage District. Sewerage work consists of approximately 11 miles of 8 to 33-inch vitrified clay pipe sewers, 90 manholes, 2 flush tanks, a pump house and pit, 2 Imhoff tanks and a sludge bed. Estimated cost, $111,214.

Peru, Ill.—Proposition for issuing of $10,000 bonds to defray new sewerage expenses in Peru has been carried by small majority.

Ft. Wayne, Ind.—Councilman Keller, of Eighth Ward, is urging Board of Works to forward plans for big main sewer for far east side.

South Bend, Ind.—Resolutions have been adopted for pipe sewers on Adams St. from Michigan Ave. to Vassar Ave.; on Dayton St., from Witwer Ave. to Miami St.; on Tecumseh Ave., from Parkovash Pl. to Pokagon Ave., and on Vassar Ave., from Portage Ave. to River Side Drive.

Burlington, Ia.—Resolution has been passed for construction of combination storm water and sanitary sewer on various streets. W. C. Cross is Mayor.

Creston, Ia.—Resolution will be voted on May 18 for sewer improvements, including about 1,160 lin. ft. of 12-in. pipe, 2,890 lin. ft. 10-in. pipe, 8,622 lin. ft. 8-in. pipe and 12,920 lin. ft. of 6-in. pipe. Theo. S. De Long, City Engineer.

Perry, Ia.—City is planing sewer system for west half of city, to comprise about 2 miles of pipe, a sewage lighting apparatus, etc. Chas. E. Wilson, City Engr., in charge.

Mount Rainier, Md.—Laws passed at recent session of Maryland legislature authorizing Mayor and Common Council of Mount Rainier to issue $125,000 bonds for installation of water and sewerage systems and electric lighting plant have been ratified at special election and plans are already being made for early beginning of work.

Rockville, Md.—Mayor and Council of Rockville and advisory committee of seven are making preliminary arrangements for construction of sewerage system, for which purpose legislature recently enacted law authorizing bond issue of $50,000.

Franklin, Mass.—At special town meeting at Franklin recommendation of Finance Committee was unanimously adopted for purpose of constructing sewerage system, town treasurer, with approval of Water and Sewer Commissioners, to be authorized to borrow sum not to exceed $75,000 and to issue bonds or notes of town therefor.

Franklin, Mass.—Town finance committee has held joint meeting with Selectmen and water and sewer commissioners to consider as to best solution of problem of completing new sewer system. After full discussion of situation it was found that estimated cost to complete system would be about $42,000 more than had already been appropriated, which is $150,000.

Haverhill, Mass.—Alderman Wood has introduced orders for laying of 18-in. sewer pipe on Water St., from Main St. to Carleton Court, at a cost of $2,000; sewer on Monument St., from Hilldale Ave. southwesterly 1,050 ft., at a cost of $1,200, 10-in. pipe; 8-in. pipe sewer on Lakeview Ave., from Commonwealth Ave. easterly 200 ft., to cost $450; and 8-in. pipe sewer on Garfield St., from Hall St. 100 ft. easterly, to cost $376. These orders were laid on table for one week.

Lowell, Mass.—Bill authorizing city of Lowell to extend Middlesex St. sewer from point near Patterson Rubber Co. to Middlesex County Truant School in North Chelmsford has been passed by legislature.

New Bedford, Mass.—Intercepting sewer committee has voted to buy Carson conveyor for work on intercepting sewer. William F. Williams, consulting engineer, recommended purchase of Carson equipment for $3,640.

Flint, Mich.—See Streets and Roads.

Flint, Mich.—City Clerk has been authorized to advertise for bids for construction of sanitary sewers on Page St., from Saginaw to Chippewa St.; Crosby St. west of Donald St. and West Fourth St. 300 ft. east of Church St.

Flint, Mich.—Resolution presented by Alderman Chatters declaring sanitary sewer on Elbert St. a necessary public improvement has been adopted.

Sault Ste Marie, Mich.—Sewer improvements will be made on about 20 streets this year.

Sturgis, Mich.—City will vote in June on proposition to lay 5,650 ft. of sanitary sewer, 8 and 10 in. in size. Also about 1,150 ft. of 18 in. storm sewer.

St. Paul, Minn.—Board has adopted favorable report on order for construction of sewer on Jessamine St., between Woodland St. and Trout brook.

St. Joseph, Mo.—Bids will be received for construction of number of sewers.

Three Forks, Mont.—See "Water Supply."

Paterson, N. J.—Ordinance has been adopted to provide for construction of sewers in certain streets and avenues and portions thereof in city of Paterson.

Brooklyn, N. Y.—New sewers will be constructed in North Flatbush.

Rochester, N. Y.—Ordinances have been adopted for construction of various sewers.

Rochester, N. Y.—Comptroller Edward S. Osborne will, on May 12, sell first of city notes to be issue for purpose of raising funds to build sewage disposal plant in Irondequoit. Notes will be for $200,000 and it is expected that low rate will be obtained.

Schenectady, N. Y.—Issuance of $300,000 city bonds for completion of sewage disposal plant has been adopted.

Syracuse, N. Y.—City Club, J. N. Alsever, will advertise for bids for completing sewer system in Huntley tract and parts of Third and Fourth wards. Sewers will cost about $90,000. Outlet will be through Butternut tunnel sewer with provision for overflow in times of high water to proposed storm water sewer which is to be built under supervision of Intercepting Sewer Board for northeast section of city to drain Ley Creek. Proposed sewers are from 12 to 66 ins. in diameter.

Akron, O.—Resolution has been passed providing for payment of $3,000 to Engineer R. Winthrop Pratt for preparations of plans for garbage disposal and sewage disposal plants.

Canal Dover, O.—New sewage disposal plant is to cost $40,000.

Dayton, O.—Bonds in sum of $30,000 will be issued for purpose of conducting survey and securing data relative to establishment of sewage disposal system in Dayton.

Newark, O.—Ordinances have been passed for construction of sewers in various streets.

New Philadelphia, O.—New sewage disposal plant will cost about $25,000.

Tiffin, O.—Ordinances have been adopted for construction of sewers in various streets.

Chester, Pa.—Clifton Heights will call election for voting on loan for sewage system.

Ellwood City, Pa.—Bond issue of $20,000 has been voted for sewer and street improvements.

New Castle, Pa.—Construction of eight new sanitary sewers and two new storm sewers is being planned for this year.

York, Pa.—Construction of about 7,366 ft. of additional storm water sewers is contemplated.

Woonsocket, R. I.—Passage of resolution appropriating $18,349 for sewer construction work has been recommended.

Salem, S. D.—Plans have been secured for system of septic tanks for sewerage system.

Dallas, Tex.—Bids will shortly be asked for construction of city sewer disposal and city filtration plants, plants for which are being prepared by Engineer James H. Fuertes.

Milwaukee, Wis.—City contemplates laying sewer pipe in Second St., from Keefe Ave. to a point 300 ft. north of Keefe Ave. Pipe sewer in south alley in block 1, from 20th St. to point 105 ft. west of 20th St., and in and along the east 10 ft. of lots 31 and 32, block 1. Pipe sewer in 22d St., from Keefe Ave. to a point 350 ft. north of Keefe Ave. Pipe sewer in 23d St., from Keefe Ave. to Peast Ct. Concrete or brick and pipe sewer in Center St., from the west line of Sherman Blvd. to a point 12½ ft. west of 45th St., and in Clarke St., from a point 12½ ft. west of Sherman Blvd. to a point 12½ ft. west of 45th St., and in 44th St. and 45th St., from Clarke St. to Center St. Pipe sewer in Hanover St., from Lincoln Ave. to a point 226 ft. north of Lincoln Ave. Pipe sewer in Odell St., from American Ave. to a point 12 ft. east of 11th Ave. Pipe sewer in Cleveland Ave., from a point 12 ft. west of 10th Ave. to American Ave., and in American Ave., from Cleveland Ave. to Harrison Ave. Pipe sewer in north alley in block 8, Mitchell Subdivision, from Seventh Ave. to a point 175 ft. west of Seventh Ave. Pipe sewer in Vermont Ae., from Oklahoma Ave. to a point 256 ft. south of Oklahoma Ave. Percy Braman is Deputy Comr. of Public Works.

CONTRACTS AWARDED.

Birmingham, Ala.—By Board of Commissioners for about three miles of vitrified pipe sewers in West End District to Thomas Worthington, First National Bank Bldg., Birmingham, at $15,236. Julian Kendrick is City Engr.

Berkeley, Cal.—By Council, contract No. 7, to R. C. Storrie, Oakland, $26,634; contracts Nos. 5 and 6, to Contra Costa Construction Co., city, $44,142 and $35,153; contract No. 8, to Michael Heafey, city, $26,729.

Hartford, Conn.—Following are bids of successful bidders for Maple Ave. sewer: Sect. A to O'Neil Bros. of Hartford, as follows: 740 ft. 66-in. concrete sewer, $14.10; 1,605 ft. 63-in. sewer vitr. block, $11.75; 1,593 ft. 57-in., $10.98; 35 ft. 36-in. brick sewer, $5; 2,000 ft. underdrain, 20 cts.; 13 standard manholes, ea., $45; 126 house connections, ea., $12; 8M. ft. lumber, $30; 4,600 cu. yds. rock excav., 50 cts.; total for vitr. clay block sewer, $52,586. Sect. B. to O'Neil Bros. of Hartford, as follows: 1,920 ft. 33-in. reinforced concrete sewer, $4; 1,000 ft. underdrain, 20 cts.; 5 standard manholes, ea., $30; 44 house connections, ea., $9; 200 yds. rock excav., $2.50; total for reinforced concrete pipe, $8,928. Sect. C to Ryan Constr. Co. of Thomaston; tile sewer in Maple Ave., 910 ft. 24-in., $2.95; 300 ft. 20-in., $2.50 300 ft. 12-in., $1.40; 300 ft. 10-in., $1.30; Freeman St., 820 ft. 24-in., $2.95 and 380 ft. 20-in., $2.40; Fairfield Ave., 937 ft. 20-in., $2.50; 320 ft. 18-in., $2.10; 2,078 ft. 15-in., $1.75; 675 ft. 12-in., $1.40; 33 standard manholes, ea., $58; 104 connections, 20 ft. long, $11; 92 connections, 15 ft. long, $8.50; capped Y branches, $2.40, $1.70, $1.05, 75 cts. and 60 cts. ea.; 2,900 cu. yds. rock excav., $3.60; total, $31,463.

Windsor Locks, Conn.—By Board of Sewer Commissioners contract for laying about 15,000 lin. ft. of sanitary sewers in Windsor Locks, to John Bowes & Co., Cohoes, N. Y., at $18,508. James D. Outerson is Town Clk.

Augusta, Ga.—To Jonas & Garrettson of West Palm Beach, Fla., at $38,000, for sewer construction, known as Contract No. 1. Nisbet Wingfield is City Engineer.

Chicago, Ill.—By Board of Local Improvements, for adjusting sewer manholes and catch basins, constructing and connecting catch basin inlets, etc., to Barber Asphalt Paving Co., Ryan Co., American Asphalt Paving Co., Ready & Callaghan Coal Co., Peter J. O'Brien and R. F. Conway Co. E. J. Glackin is Secy.

Chicago, Ill.—By Board of Local Improvements for adjusting sewer manholes and catchbasins on various streets to R. F. Conway Co.; American Asphalt Paving Co., Barber Asphalt Paving Co., E. P. McCormick, the Ryan Co., R. F. Conway and Calumet Coal & Teaming Co.

Gridley, Ill.—To Driscoll & O'Brien of Decatur, Ill., at $7,199, for excavating and laying 3,200 ft. of 20-in. vitrified saltglazed drain tile, and about 1¼ miles of 15, 14, 12 and 10-in., with hub and socket; 18 manholes, brick wall, 8 ins., and 800 ft. of 8-in. street connections and intakes.

Rankin, Ill.—To John W. Ryan, of Springfield, Ill., at $15,736, for installation of sewers, and Carson Payson Co., 22 E. Harrison St., Danville, Ill., at $1,000, for construction of septic tank.

Fort Wayne, Ind.—By Board of Works to W. J. Stevenson of Milwaukee, Wis., for purchase of one of the Stevenson

turbine sewer-cleaning machines, of which one has been in use in demonstration. Price, $600. Contract will go to City Council for approval.

Chestertown, Ind.—For constructing sewer system, to S. A. Smith, Gary, at $21,824. Other bidders: T. Campbell, Muskegon, Mich., $25,192; L. E. Barns, Hobart, $26,556; Staples & Ackerman, South Bend, $24,015. Chas. W. Cole, is Engr., Mishawaka.

Portland, Ind.—Bids have been opened for construction of South Sewer in South Portland. There were three bids submitted to Council, as follows: Frost & Sprinkle, $7,463.05, $7,428.05; Fitzmaurice & Beard, $7,701; Griffith & Antrim, $7,988.15. Council accepted bid of Frost & Sprinkle, at $7,428.05.

Baltimore, Md.—To C. B. Clark & Co., Baltimore, at $118,683, for Sanitary Contract No. 133, Imhoff tanks, sludge tanks and sludge filter beds.

New Bedford, Mass.—Contract for catch basin castings and manhole covers has been awarded to Fairhaven Iron Foundry Co. at $1.95 for catch basin covers, and $8 for manhole covers. Sessions Iron Foundry submitted price of $7.90 for manhole castings. Contract for sewer pipe was awarded to Paisler & Willis, lowest bidders, who offered to supply Portland Stone Ware Co. pipe at following discounts: 71¾ per cent. off for 6-inch to 24-inch; 63¾ per cent. off for 27 to 30-inch pipe, and 58¾ per cent. off for 33 to 36-inch pipe.

Kansas City, Mo.—By Board of Public Works, contract to Brown Bros., 1963 N. Hallock St., Kansas City, Kan., at $53,743, for sewers; also to L. E. Koehler, 78th St. and Troost Ave., Kansas City, Mo., at $4,918.

Passaic, N. J.—To Maybury Engineering & Contracting Co., Clifton, N. J., at $2,506, for sewer and house connections in Brook Ave.

Passaic, N. J.—Following prices have been received by the Board of Commissioners of the City of Passaic, N. J., for laying an asphalt-bound macadam (penetration method) and the extension of the 20-inch storm water sewer in Burgess Place: No. 1, DeVogel Contracting Co., Passaic, N. J., $9,681.03 (contract awarded); No. 2, Clement C. Cogan, Bayonne, N. J., $14,940.05; No. 3, A. W. Gill, Hackensack, N. J., $13,240.00; No. 4, Philip & Peter Jannarone, Belleville, N. J., $10,983.59; No. 5, Union Bldg. & Construction Co., Passaic, N. J., $9,871.40. Asphalt-bound macadam 7-in., (1) 91 cts.; (2) $1.42, (3) $1.25, (4) $1.10, (5) 92 cts.; reset curb, (1) 9½ cts., (2) 15 cts., (3) 10 cts., (4) 7 cts., (5) 10 cts.; new manhole, (1) $45, (2) $35, (3) $60, (4) $45, (5) $40; 6-in. house connections, (1) 60 cts., (2) 70 cts., (3) 55 cts., (4) 40 cts., (5) 70 cts.; manhole heads reset, (1) $7, (2) $5, (3) $6, (4) $10, (5) $7; header curb, (1) 52 cts., (2) 60 cts., (3) 56 cts., (4) 50 cts., (5) 50 cts.; 20-in. pipe sewer, (1) $1.50, (2) $2.80, (3) $1.60, (4) $1.25, (5) $1.80; concrete basins and conduit, per lin. ft., (1) $3.25, (2) $5, (3) $7.50, (4) $1.56, (5) $3.40; round bluestone corner, (1) $15, (2) $8, (3) $7.50, (4) $2.50, (5) $15.

Rochester, N. Y.—By Board of Contract & Supply, contract for construction of sewerage disposal plant in Irondequoit to Myers & McWilliams, low bidders, at $333,855.

Maumee, O.—For constructing main and outlet sewer in Key St. sewer district, requiring 1,040 lin. ft. of 60-in. pipe to Albert Grabouski, Toledo, at $10,882.

Urbana, O.—Bids on sewage disposal plant have been opened by Board of Control. There were five bids submitted. They were tabulated by City Engineer Sweetman. Firm of Cooke and Cooke, of Clintonville, had lowest bid, $37,077.05. The next lowest bid was that of J. C. Devine Co., of Alliance, who bid $37,495. Other bidders were: D. E. Sullivan & Co., of Columbus; the Jones Construction Co., of Mt. Vernon, and William Hayes & Son.

Urbana, O.—Contract for sewage disposal plant has been awarded by Board of Control to Cooke & Cooke, of Clintonville, at their bid of $3,707.05.

Okmulgee, Okla.—For constructing sewers in Districts Nos. 14, 15, 16 and 18, to R. G. Fritts, Okmulgee, at $41,403. Other bidders were J. O. Severns, at $43,550, and Standard Roofing Co., at $45,275.

Bradford, Pa.—For 6,600 lin. ft. 6 to 10-in. vitr. pipe sewer, 19 manholes, 3,000 cu. yds. excav. to Sheehan & Emery, Bradford, at $11,400. Other bidders: M. Applegate & Son, Bradford, $12,796; Olean Constr. Co., $11,850. E. C. Charlton is City Clk.

Wilkinsburg, Pa.—To Ott Bros. Co., 414 Washington St., Pittsburgh, Pa., at $13,702.68, for approximately 2,434 lin. ft. sewer, 8 manholes and 13 inlets.

Jamestown, R. I.—Bids for sewer construction on Clinton Ave. are as follows: Antone Silvia, excavating, 65c. per ft; rock, 30c. per running ft.; manholes, $40 each; Manuel Vera, 70c., 35c. and $35, $1 extra for Y's. First-named received the contract. For Columbia Ave.: Antone Silvia bid 70c., 30c., and 62c. for Y's; Manuel Vera, 70c., 35c., and $1 for Y's. Latter was given to Manuel Vera. On Calvert Pl. sewer there was only one bidder, Antone Silvia, and he was given the contract.

Henderson, Tenn.—Contract for Forked Deer drainage district, Chester County, has been let to D. W. Robins, of Tupelo, Miss., for $48,000 complete, about 600,000 cu. yds., which is about 7 cts. per cu. yd. for main ditch and 11 cts. for lateral ditches. Main ditch and laterals is 25 miles and assessed acreage is 9,000.

Everett, Wash.—To Atlas Construction Co., city, at $135,600, for construction of extension of sewer system.

Esquimalt, B. C.—To Hugh MacDonald, of Victoria, B. C., at about $60,000, for construction of first unit of Esquimalt sewer system.

Saskatoon, Sask.—For sewer pipe and specials, contract was awarded to Mackenzie & Thayer, Ltd., Saskatoon, agents for American Sewer Pipe Co., Akron, O., at $7,292.

WATER SUPPLY

Oroville, Cal.—Erection of pumping station in Road District No. 1 below Oroville has been ordered. Water for road sprinkling purposes will be pumped from Feather River and stored in big tank.

Wilmington, Del.—Wilmington Water Commissioners have decided to expend $50,000 for installation of water meters.

Columbus, Ga.—It has been stated that $450,000 worth of bonds voted by city for the purpose of constructing a waterworks system to be owned by municipality would be offered for sale July 1.

Aurora, Ill.—Board of Public Works is planning for construction of about five miles of water mains in Arlington Heights addition to cost $25,268. Myron J. Tarble is City Engr.

Moline, Ill.—Bids will be received on May 12 for constructing water mains in East End Watermain District, work consisting of approximately 13 miles of 4 to 12-in. cast-iron pipe, 138 fire hydrants and 80 valves and boxes. Estimated cost, $102,566. Pumping equipment consists of 2 7-in. centrifugal pumps, 2 15-h.p. electric motors and 2 automatic float controllers. Estimated cost, $1,775.

Moline, Ill.—Bids will shortly be asked for laying of water mains in this city. Contract will amount to $109,000.

Perry, Ia.—Plans and specifications for concrete reservoir for city water works are nearly complete. R. B. Reasoner is Engr. in charge.

Kensington, Md.—Citizens have voted $50,000 bonds for construction of water system and sewerage system.

Mount Rainier, Md.—See "Sewerage."

Boston, Mass.—Four miles of streets in this city are to be torn up during next five months for installation of high-pressure fire system. Work is beginning of general system, affecting 14 miles of streets.

Fall River, Mass.—Proposition for creation of auxiliary plant at pumping station is again being given consideration by Water Board.

Mansfield, Mass.—By voting to issue bonds amounting to $75,000 to improve its water works, Mansfield has voted to build storage water reservoir that will be one of largest in state. Its capacity will be 1,500,000 gals. Its diameter will be about 146 ft., and depth of water, 12 ft. Location will be on Foolish Hill, a rocky elevation in Foxboro. Length of piping from plant to reservoir will have to be 7,800 ft. Estimated cost of reservoir alone will be about $20,000, and connecting pipe line, land, etc., will be an expenditure of some $19,000 more. Other intended improvements are: Boiler room wing and connections, estimated at $2,000; new boiler and setting, $2,000; steam piping and appliances, $1,500; engine room wing, $2,800; new pumping engine and foundation, $11,000; new and independent suction and discharge connections, etc., $2,000; engineer's house, $4,000; signalling and recording devices, $400.

North Attleboro, Mass.—Water Commissioners have made arrangements for construction of water mains on several streets as follows: Poplar St., 450 ft.; Fales St., 300 ft.; Elmwood St., 800 ft.; James St., 300 ft.; Oakhurst St., 575 ft.; Tifft St., 250 ft.

Grandville, Mich.—Water works system will be installed.

Saginaw, Mich.—On Monday, April 27, Saginaw is to vote upon question of authorizing bond issue not to exceed $700,000 for purpose of building and installing new water works system. Estimates for work are made on liberal scale so as to be rather in excess of actual cost than under, and engineer's figures are following: Intake and raw water tunnel, $131,700; pumping station, $65,000; high lift pumps, $75,000; low lift pumps, $15,000; boilers, $17,000; piping and auxiliary machinery, $12,000; settling basins, $51,000; filters and appurtenances, $150,000; filtered water reservoir, $32,000; force mains, $68,000; land, $——; total $616,710; 15 p. c. engineering and contingencies, $92,500; grand total, $709,200. The proposed plant is of 15,000,000 daily capacity.

Three Forks, Mont.—Initial step toward installation of water works and sewerage system has been taken, when by vote of 104 to 36 Three Forks taxpayers voted to bond city for $45,000 for purpose of purchasing site for reservoir, digging of wells and laying of trunk line for water works.

East Syracuse, N. Y.—Village Board has authorized sale of $15,000 bonds for extending water system.

Lyons, N. Y.—J. F. Witmer, the engineer having in charge plans for construction of new municipal water plant in this village, is now at work with party of surveyors running line from Junius ponds to this village for purpose of making estimate of cost of bringing water here by gravity.

Plattsburg, N. Y.—Special election will be held on May 21 for voting on $50,000 bond issue for completion of present reservoir under construction, and for purchase of lands on west brook, and laying of cast-iron water mains.

Asheville, N. C.—Board of Aldermen of West Asheville has passed motion providing for advertising for bids for construction work incident to laying of water and sewer lines throughout the town. Bond issue of $50,000 was sold some time ago and plans for the work have been adopted.

Columbus, O.—Council Committee on Finance and Water Works have approved appropriation ordinance of $125,000 for purchase of third pumping unit at water pumping plant.

Toledo, O.—City Solicitor will prepare legislation for $180,000 bond issue for construction of high-pressure pumping station.

Oregon City, Ore.—City Council has appropriated $6,000 for making final survey and preparing plans for 26-mile pipe line from south fork of Clackamas river. Line will have a capacity of 3,000,000 gals. for 24 hours, and will be of wood pipe construction. Hurlbut & Rands are engineers, Portland.

Barnesboro, Pa.—It is proposed to install water works at cost of $17,500.

Pittsburgh, Pa.—Charles A. Finley, Supt. Water Bureau, is preparing for connecting Northside water system with City system by 48-in. main to cross the Allegheny River at 26th St. It will be about 3,000 ft. long and will cost about $120,000.

Allendale, S. C.—Citizens have voted to issue bonds for $65,000 for installation of water, sewer and electric light systems.

Orangeburg, S. C.—City would like to receive catalogues, etc., from manufacturers of up-to-date machinery for installing water and electric light plant. F. J. D. Felder, Councilman, is interested.

Regina, Sask.—Bonds in sum of $360,- have been approved for extension of water system. L. A. Thornton is Water Comr.

Dallas, Tex.—Bids will shortly be asked for construction of city filtration and sewage disposal plants, plans for which are being prepared by Engineer James H. Fuertes.

Salt Lake City, Utah.—City Commission will construct 6 water mains, on State, Fourth, N and other streets. Estimated cost, $12,575.

Milwaukee, Wis.—Bids will be received by Dept. of Public Works until May 8, for furnishing materials and doing work necessary to construct system of distribution wells, tunnels and gate wells. Separate figures are to be submitted on following: Price per lin. ft. of 9 ft. diameter tunnel, including bulkheads, gate wells and connections. Price per lin. ft. of 8½ ft. diameter tunnel, etc.; price per lin. ft. of 5 ft. diameter tunnel, etc.; price per lin. ft. of 12 ft. diameter distributing well; price per lin. ft. of 10 ft. diameter distributing well, and price per lin. ft. of 8 ft. diameter distributing well. Percy Braman is Deputy Comr. of Pub. Wks.

CONTRACTS AWARDED.

Thomasville, Ala.—By city contract for construction of water system to Sullivan, Long & Hagerty, Bessemer, Ala., at $18,000.

Montague, Cal.—To Krogh Mfg. Co., San Francisco, for pump for water works, at $1,852. John S. Musgrave is City Clerk.

Jacksonville, Fla.—By Board of Bond Trustees for improving water system to F. W. Long, Jacksonville, at $37,360.

Byron, Ill.—To W. H. Woolcox, of Oglesby, Ill., at $4,000, for water works extension.

Carpentersville, Ill.—To Logan & Gierlz, Elgin, Ill., at $19,476, for water works.

South Bend, Ind.—Contract between Board of Works and Lynchburg Foundry Co., of Lynchburg, Va., for purchase of 300 to 400 tons of cast-iron water pipe, at expenditure of about $1,000, has been passed under suspension of rules by Council. Pipe is for increasing extension of city's water main system.

Perry, Ia.—To C. W. Roland Co., of Des Moines, contract for 7,152 ft. 4-in. mains for west part of city. Chas. E. Wilson, City Engr., in charge.

Herington, Kan.—For construction of water system, according to plans by Benham Engineering Co., Oklahoma City, Okla., to Tonkawa Construction Co., Tonkawa, Okla., $29,022. Other bidders were: Everet & Burt, Hutchinson, Kan., $29,369; Commercial Construction Co., Kansas City, Mo., $31,789; Sherman Machine & Iron Works, Oklahoma City, Okla, $30,887; T. C. Brooks & Co., Jackson, Mich., $30,654.

Pittsburg, Kan.—For air compressor pumping device, to Laidlaw, Dunn, Gordon Co., New York, at $9,200. Leonard Boyd is City Clerk.

Boston, Mass.—By Metropolitan Water & Sewerage Board for water pipe tunnel under Chelsea Creek to Coleman Bros., of Boston, at $60,300. Their itemized bid was as follows: 1,300 lin. ft. spruce piles driven and cut off, 30 cts.; 5,200 lin. ft. oak piles driven and cut off, 60 cts.; 24 M ft. long leaf y. p. lumber for bulkhead, foundations, etc., $60; 4 M ft. long leaf y. p. lumber for walks and fences, $75; 640 lin. ft. tunnel, $78; 300 lin. ft. 36 and 24-in. c.-i. water pipe (to lay), $1.50; 240 lin. ft. 12 and 8-in. c.-i. water pipe for blow-off (to lay), $1; 7,000 cu. yds. earth fill, 40 cts.; 1,540 lin. ft. 24-in. c.-i. water pipe (to remove), $1; 10 cu. yds. rock excavation, $10.

Lowell, Mass.—Following contracts have been awarded by Purchasing Agent Foye: Casting for the water department, including manhole frames and covers, etc., James P. Robinson Iron Foundry, $1.57 per 100 lbs.; Smith & Lovett Co., $2.10 and $2.45; City Iron Foundry, $2.25; Peevey Foundry Co., $2.74. Contract goes to James P. Robinson Iron Foundry.

Mattapoisett, Mass.—The Mattapoisett Water Commissioners have opened bids of contractors for extension to Mattapoisett water system to Crescent Beach. There were only two bids received, that of Hanscom Const. Co., of Boston, for $9,859.30 and that of Murerer Const. Co., of Providence, for $10,250. It was voted that contract be awarded to low bidder, and that work be started immediately.

North Attleboro, Mass.—At last meeting of Board of Water Commissioners bids were received for furnishing of 50 tons of 6-in. cast-iron water pipe as follows: R. D. Wood & Co., Philadelphia, Pa., $21.70 per ton; John Fox & Co., New York, $22.10 per ton; M. J. Drummond Co., New York, $22.60 per ton; Lynchburgh Foundry Co., New York, $2.65 per ton; Charles Millar Sons Co., Utica, N. Y., $22.70 per ton; Allen & Reed Co., Providence, R. I., $22.90 per ton; United States Cast Iron Foundry Co., Philadelphia Pa., $22.95 per ton; Warren Foundry Co., New York, $23.40 per ton. Contract was awarded to R. D. Wood Co., of Philadelphia, the lowest bidder.

Long Pine, Neb.—For erecting standpipe to Chicago Bridge & Iron Works, Chicago, Ill., at $3,970. Thos. S. Heck is Village Clerk.

Allendale, N. J.—To Melrose Construction Co., 147 E. 125th St., New York City, at $37,300, for water works distribution system.

Cobbleskill, N. Y.—To International Filter Co., Buffalo, N. Y., contract for improving water supply system, at $12,000.

Morris, N. Y.—To D. I. Snell & Co., of Canajoharie, N. Y., at $19,840, for constructing storage reservoir of reinforced concrete, and slow sand filter.

Rochester, N. Y.—Contract for laying water pipe in group 256 has been awarded to Passero & Petrossi for $551.70.

Youngstown, O.—By Board Public Service for erecting pumping station to Heller Bros., Youngstown, at $115,000.

Stigler, Okla.--By Board of Town Trustees for extension of water system to Tonkawa Construction Co., Tonkawa, Okla., at $8,286: Other bids were: J. S. Weathers, Muskogee, Okla., $8,911; John W. Rook, McAlester, Okla., $8,951; J. S. Terry Construction Co., Poteau, Okla., $9,097; Talbot Construction Co., Ada, Okla., $9,000.

Gastonia, S. C.—To Porter & Boyd, of Charlotte, N. C., for construction of settling basin for city water works, to be built near pumping station on Long Creek, to have capacity of 7,000,000 gals.

Galveston, Tex.—To U. S. Cast Iron Pipe Co., at $8,335, for supplying 11,500 ft. of 8-in. c.-i. water pipe, 1,667 ft. of 6-in., and 20 tons of special fittings.

Humboldt, Sask.—To Flanigan & Murphy, of Fort Williams, at $100,000, for installation of new water works and sewerage systems.

LIGHTING AND POWER

Sacramento, Cal.—City Electrician has been authorized to prepare plans and specifications for municipal electric light distributing plant.

Sacramento, Cal.—Purchase of $9,600 worth of municipal street lighting bonds by use of portion of William Land indigent fund will make possible commencement of work on system in near future. City Commissioner E. M. Wilder has announced that $9,600 would be used for sub-station, which will be first unit in municipal lighting plant.

Micanopy, Fla.—Arrangements are in progress for installation of municipal electric light plant, for which bonds to amount of $10,000 have been authorized.

Ft. Wayne, Ind.—Bids will be received on May 16 by Board of Works for construction of new building at city lighting plant, and installation of traveling crane. Contracts for furnishing new units already have been let.

Rensselaer, Ind.—City may purchase at once conduit for ornamental street lighting system and in a few months 42 ornamental lamp standards. C. S. Chamberlain is Superintendent.

Paton, Ia.—Bonds have been voted for electric lighting system.

Effingham, Kan.—Citizens have voted in favor of bond issue of $12,000 for installation of municipal electric lighting system.

Summerfield, Kan.—E. B. Murray and L. C. Hamilton, associate engineers, Missouri Savings Bank Building, Kansas City, Mo., are preparing plans for installation of municipal electric lighting system at cost of about $12,000.

Melville, La.—Proposal to issue $15,000 in bonds for installation of a municipal electric light plant will be voted on May 2. Anderson Offutt, of New Orleans, is electrical engineer.

Mount Rainier, Md.—See "Sewerage."

Lynn, Mass.—An extension of great white way has been authorized by Municipal Council, running from Lynn Shore Drive, by way of Nahant St., to business section of city, and replacing 13 incandescent lamps and 12 pendant arcs. New lights will cost city $220 more than present system. White way is also to be extended in business section of city by replacement of two pendant arcs with white way lamps, one at Washington and Railroad Aves and other on Washington St., opposite the Lynn Sporting Goods Company.

Unionville, Mich.—Preparations are being made for installation of municipal electric light plant to cost about $8,000.

Lamberton, Minn.—Council has granted 10-year franchise for installation of electric light plant. Ornamental lamps will be used in business district.

Kahoka, Mo.—Election may be called for May 12 for voting on $11,000 bond issue for electric lights.

Lewistown, Mont.—Bids will be received by City Council about May 11 for installation of lighting system in business district.

Bruning, Neb.—Bids will be received by village clerk about May 12 for construction of electric light system to cost $7,308. Grant & Fulton of Lincoln are engineers. G. G. Bruckert is Village Clk.

Rahway, N. J.—Common Council is discussing advisability of municipal lighting plant. Estimated cost, $50,000.

Baldwinsville, N. Y.—New street lighting system is being discussed.

Binghamton, N. Y.—Ordinance calling municipal lighting bonding election for May 29 will be passed.

Prospect, N. Y.—Village has decided to install electric lights at special election.

Marion, O.—Installation of cluster lights for West Center St. is being considered.

Drain, Ore.—Ordinance has been passed authorizing construction of municipal electric light plant and $15,000 bond issue to provide funds for same.

Wallowa, Ore.—City Council has approved plans for erection of municipal lighting and power plant. Estimated cost of power house, distributing system and diversion dam will be around $35,000.

Allendale, S. C.—Bonds in sum of $65,000 have been voted for installation of electric lighting, water and sewer system.

Orangeburg, S. C.—City would like to receive catalogues, etc., from manufacturers of up-to-date machinery for installing electric light and water plant. F. J. D. Felder, Councilman, is interested.

Spartanburg, S. C.—City Council is discussing question of installing ornamental street lighting system in business district. Plans considered provide for installation of 88 arc lamps to take place of 25 arc lamps.

Niagara Falls, Ont.—It has been estimated that new ornamental lights will cost $16,000.

CONTRACTS AWARDED.

Chicago, Ill.—By Sanitary District of Chicago, contract for electrical equipment, etc., for Lincoln St. and Rice St. substations to W. A. Jackson Co., of Chicago, at $26,800.

Muscatine, Ia.—Council has awarded street lighting contract to Muscatine Lighting Co.

Pittsburg, Kan.—For 22 blocks of special street lighting poles, of combined trolley pole type with 4 pendant lights and ball globes, contract was awarded to United Iron Works Co., Pittsburg, Kan., at $12,384. L. E. Curfman is City Engineer.

Pittsburg, Kan.—White Way contract has been awarded to the United Iron Works at $12,383.

Grand Rapids, Mich.—To Heine Boiler Co. contract for boilers for new South End high school building, Jefferson Ave. and Hall St.

Gastonia, N. C.—Contract for laying eight or ten miles of gas pipe has been awarded by Gaston County Gas Co. to Contractor W. O. Pratt.

Oak Harbor, O.—By Trustees Public Affairs for electric light system from plans of Vance I. Gray, electrical engineer, Toledo, as follows: W. J. Nagel Co., Toledo, switchboard, $1,302; Jos. Skeldon Eng. Co., Toledo, pumps, $1,340; general construction, to Gangle-Harbaugh Co., Akron, $7,196.

FIRE EQUIPMENT

Batavia, Ill.—Purchase of motor chemical wagon is being discussed.

Moline, Ill.—Bonds in sum of $34,000 for purchase of motor apparatus may be issued. John Q. Hawk is Chief.

Moline, Ill.—Bids will be received on May 15 for two or three motor-driven hose cars; one combination pumping engine and hose car; one motor-driven runabout or roadster; one 75-ft. aerial truck, complete, and 15 fire alarm boxes.

Kendallville, Ind.—City Council will investigate the need of long ladders.

Warsaw, Ind.—The Winona Lawe Town Council has placed order for gasoline fire engine, 1,000 ft. of fire hose and two hose reels at cost of $2,200.

Waterloo, Ia.—Purchase of motor service truck for fire department is being discussed.

Fort Scott, Kan.—Fire Chief Ausman has asked the commissioners for new hose for the Fire Department.

Hutchinson, Kan.—Immediate purchase of two pieces of motor apparatus and 2,000 ft. of hose is recommended by Fire Chief A. J. Stout.

Greenfield, Mass.—Proposition to purchase additional motor apparatus has been voted upon.

Albion, Mich.—Council has ordered purchase of motor combination chemical and hose wagon.

Flint, Mich.—Purchase of new apparatus for Fire Department, including five new style alarm boxes at total cost of $541.50, has been authorized on resolution of Alderman McKeighan.

St. Joseph, Mo.—Modernizing of fire department is being planned.

Livingston, Mont.—Purchase of motor combination chemical and hose wagon has been recommended.